Electrical World

JANUARY 6, 1945

ion-Wide Survey on
luorescent Lighting
for Small Stores

Large-Scale
Frequency Meter
to Guide Operators

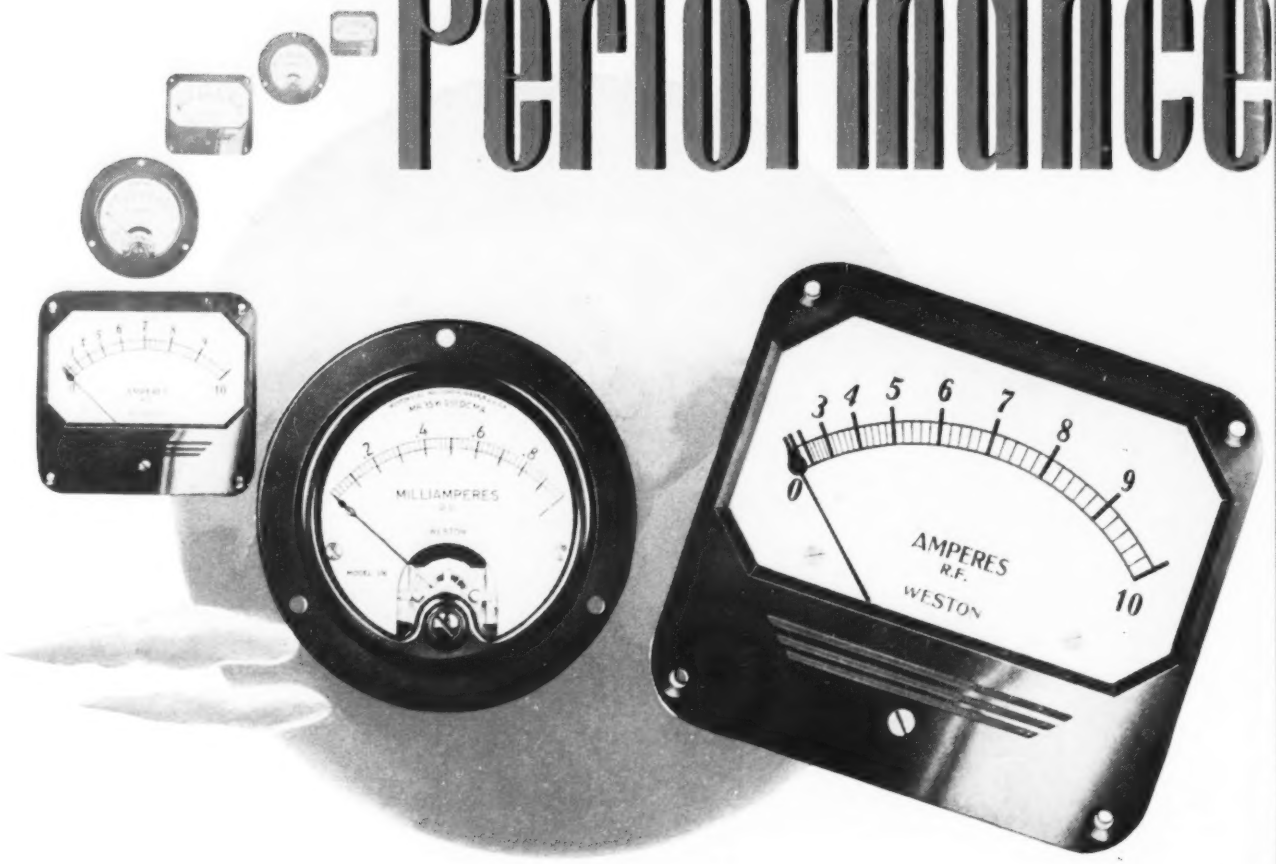
pacitor Calculations
for Industrial Use

Scheme to Cut
Welder Flicker

Next Issue
ANNUAL STATISTICAL REVIEW
January 20

onous Condenser Converted
to Outdoor Use

known Performance



for destinations known or unknown

Today, our electrical equipment encircles the globe; some serving at Greenland's ice cap or in Kiska's fogs . . . others stewing in the swamps of a Pacific atoll.

With the destinations of war-products totally unknown, manufacturers logically have preferred "building-in" WESTONS on their control panels. They know that a WESTON will perform dependably *anywhere* . . . that there is sound reason behind WESTONS acceptance as the *international standard.*

And tomorrow, with equipment reaching known markets, instrument preferences will remain unchanged. For while human life no longer will be at stake, *reputations will.* So manufacturers will continue to "build-in" the instruments which consistently tell-the-truth . . . to build broader market acceptance and customer good-will, and assure highest efficiency from the machines which bear their name.

- Laboratory Standards
- Precision DC and AC Portables
- Instrument Transformers
- Sensitive Relays
- DC, AC, and Thermo Switchboard and Panel Instruments
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- Exposure Meters
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ELECTRICAL WORLD

Published weekly. Price 25 cents a copy. Publication office 99-129 N. Broadway, Albany 1, N. Y. Allow at least ten days for change of address. Address communications about subscriptions to Director of Circulation, Electrical World, 330 West 42nd Street, New York 18, N.Y.

RETURN POSTAGE GUARANTEED

Subscription rates: In the United States, Mexico, Central and South American countries, $5 a year, $8 for two years, $10 for three years; Canada, $6 for one year, $10 for two years, $12 for three years (Canadian money at par). Great Britain and British possessions, 60 shillings for one year, 120 shillings for three years. All other countries $9 for one year, $18 for three years. Please indicate position and company connection on all subscription orders. Entered at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

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Founder and Honorary Chairman
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Editorial and Executive Offices
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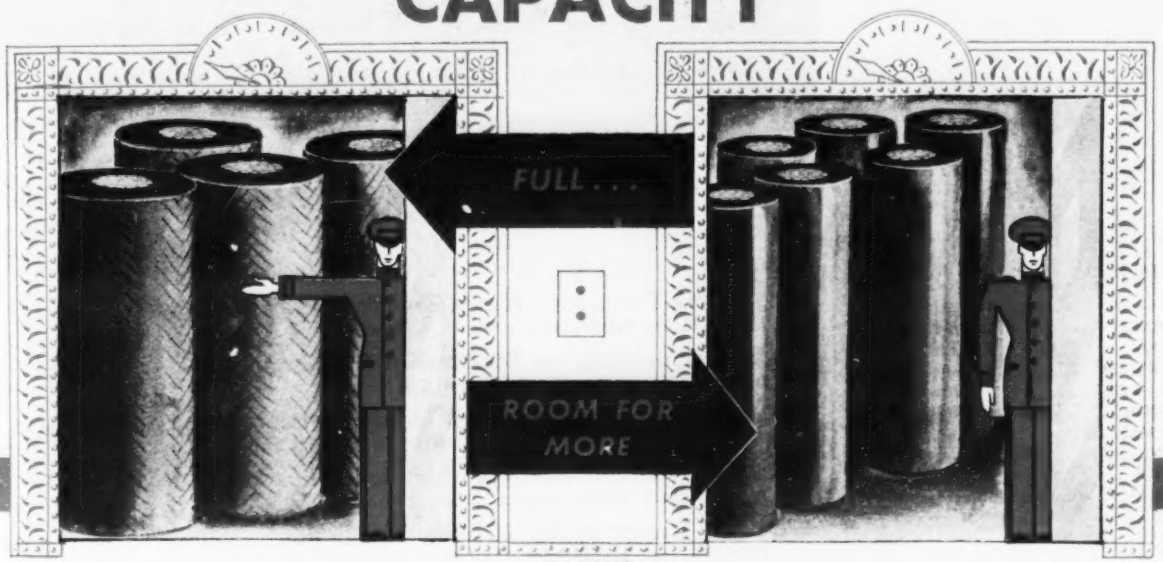
13% TO 28% INCREASED CIRCUIT CAPACITY



with

HAZAKROME

Type SN

SMALL DIAMETER WIRE

HAZAKROME insulation, although very thin, affords excellent electrical insulation and physical protection and eliminates the usual cotton braid covering. The diameter of the cable is thereby reduced from that of the regular Type R wire, so that 13% to 28% more wires can be put into an existing conduit. This is especially valuable on rewiring jobs where replastering and refinishing becomes an expensive item.

Wiring repair contracts are at a minimum in wartime. New building construction is at a standstill. However, when this accumulation of needed electrical work can be done, if you use HAZAKROME Type SN Small Diameter Wire you will save many costly installation hours and obtain long time satisfaction.

WHAT IS HAZAKROME?

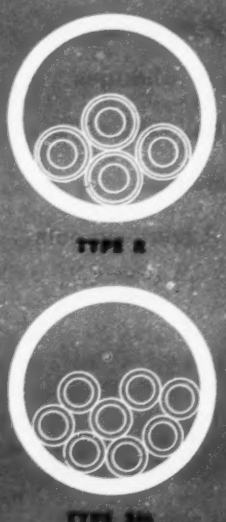
HAZAKROME is a synthetic plastic having a smooth, glossy finish for easy pulling and a leatherlike toughness and flexibility. Its high degree of durability and resistance makes cotton braid and other fibrous covering unnecessary.

HAZAKROME has most of the desirable qualities of rubber insulation—plus others not possessed by rubber, such as non-inflammability and resistance to moisture, oil and ozone.

Splicing and soldering are easy with Hazakrome easy-stripping insulation.

Standard Building Wire colors for circuit identification are available.

Send for HAZAKROME HANDBOOK



TYPE R

TYPE SN

ELECTRICAL CHARACTERISTICS

DIELECTRIC STRENGTH. Every length of completed wire, after not less than 12 hours immersion in tap water in room temperature, must stand the following high potential tests for a period of one minute:

Sizes 14 - 8 Awg	1500	volts
" 6 - 2 "	2000	"
" 1 and larger	2500	"

DIELECTRIC RESISTANCE. Hazakrome Type SN wire must show an insulation resistance constant of not less than 500 at a temperature of 15.5°C (70°F).

HAZAKROME Type SN because of its superior heat resistance will safely withstand a maximum copper temperature of 60°C (140°F). This gives it about twenty per cent greater carrying capacity than the corresponding sizes of Type R Code Building Wire.

HAZARD INSULATED WIRE WORKS

DIVISION OF THE OKONITE COMPANY

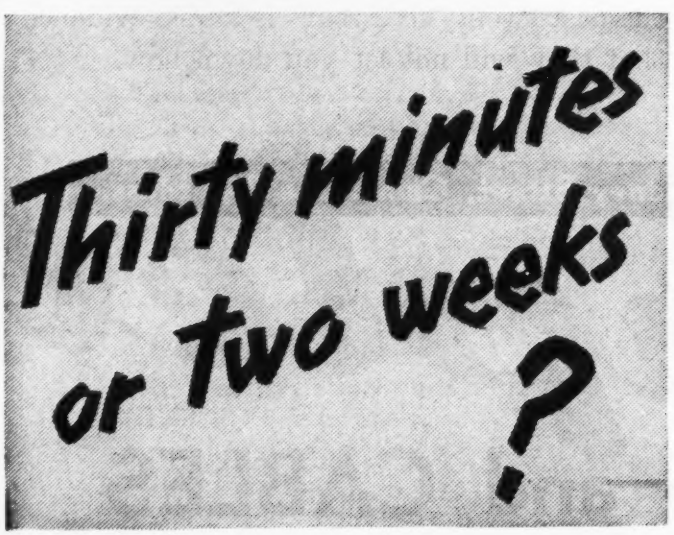
Wilkes-Barre, Pa. • Offices in Principal Cities

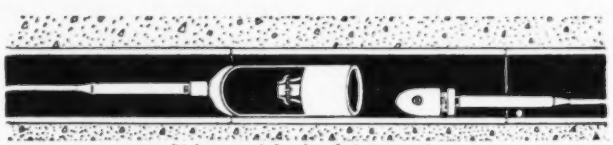
UTILITIES have found that one gang, with Electroline Steel Duct-Rodding Equipment, can make a half-hour job out of one that formerly took two gangs two weeks with old-style equipment!

In consequence, they have made amazing savings in labor cost alone. Add to this lower first cost, the lower handling cost, and longer life . . . then you have their reason for adopting Electroline's speedy, economical Duct-Rodding Equipment.

The construction is simple and trouble-free, yet affords the outstanding advantages of easy, efficient rodding and great durability in service.

You can turn days into minutes, too—by speeding up installation and cutting costs with Electroline Duct-Rodding Equipment. Get full details and prices . . . write for a copy of descriptive Bulletin 939.



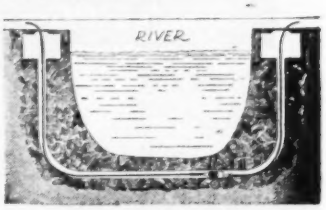


Pick-up and Leader fittings meeting.

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.

PATENT APPLIED FOR



Electroline Company

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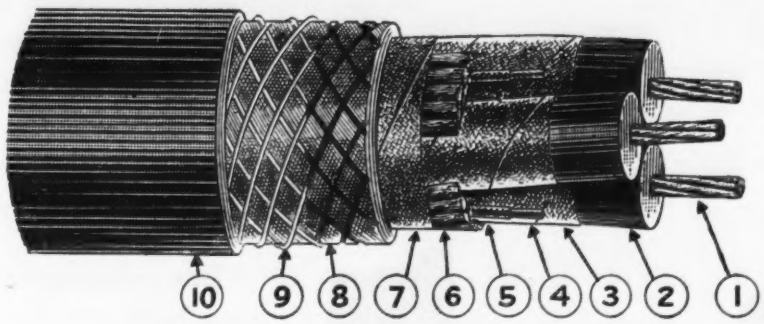
Performance Records Prove Simplex-Tirex Quality



Simplex - Tirex Type G

If you could watch the manufacture of TIREX Cords and Cables, follow them step by step, process by process through our plant, you would clearly understand why they are so good. From the small copper wires that make up the flexible conductor right through to the smooth, tough, abrasion resistant rubber sheath, they are designed for hard service. Each is as good as we can make it and performance records furnish abundant evidence that there are none better.

A small TIREX cord for a portable tool is made with the same care and precision as a TIREX cable for a mammoth shovel or dredge. Careful selection of materials, skilled workmanship, frequent inspections and tests, these all lead up to a finished product from which it is reasonable to expect trouble-free service.

Type W - without ground wires.
Type G - with ground wires.
Type SH-A - without ground wires, shielding over each conductor.
Type SH-B - without ground wires, shielding over cabled conductors.
Type SH-C - with ground wires, shielding over cabled conductors.
Type SH-D - with ground wires, shielding over each conductor.

If you need an electric cord or cable where flexibility, electrical stability and abrasion resistance are important you can trust TIREX. The satisfactory service that TIREX rubber sheathed cords and cables have rendered to mines, quarries, shipyards, railroads and industry of every sort during the past twenty-five years is ample evidence that they will not let you down now.

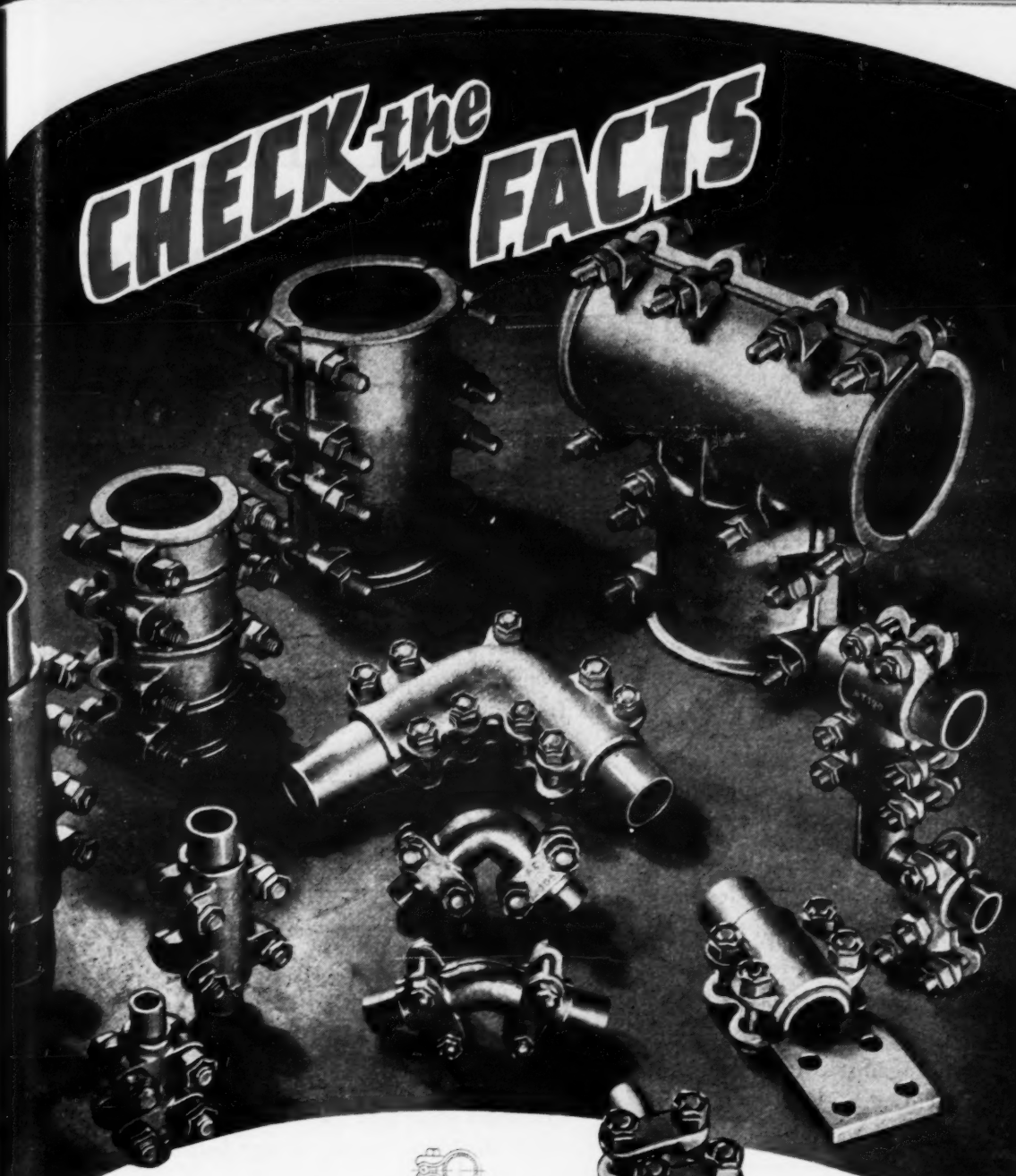
Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

ARMY (E) NAVY

M★★★

Simplex WIRES and CABLES

CHECK the FACTS



The Check List

- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- HORN GAP SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SECTIONALIZING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

GROUND CLAMP

BAR CLAMP

TERMINAL

LIVE LINE CLAMP

1. Designed for high strength and high conductivity — with a proper use of metal.
2. For every need — from small cable clamps to heavy duty power connectors — R & I E standard or designed fittings meet all requirements.
3. The quality of R & I E fittings is measured by long years of continuous service on small circuits or large, critical, industrial buses.
4. All business is big business to R & I E — one or one hundred fittings receive equal attention in design and production.

R & I E

CONDUCTOR FITTINGS

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.
IN CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

Good Engineering is

. . . and Nowhere is that More True Engineering. Here are Six Examples

1. RIGHT PROPORTIONS FOR HEAVIER LOADS

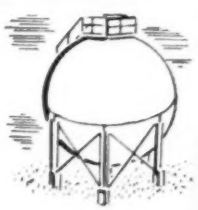
REASONS WHY Allis-Chalmers uses *shell-type* construction for all large, high voltage power transformers are both simple and basic:

a) Better distribution of impulse voltages through vertical disc coils, which give less capacitance to ground;

b) Greater dielectric strength, through use of solid insulation between coils, in combination with vertical oil ducts;

c) Sturdy bracing against over-currents, with 80% of windings enclosed in steel.

2. ROUND SHAPE PREVENTS BULGING

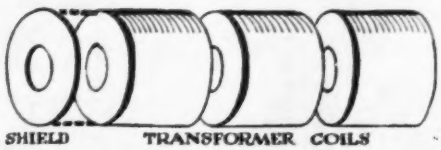


A TRANSFORMER COIL naturally tends to assume a circular shape under short circuit conditions. Therefore, it's good sense to avoid deformation stress by making coils circular *to begin with*. That's one reason why Allis-Chalmers uses circular coil construction on all power transformers.

Another reason: Circular coils can be wound with uniform tension at all points . . . without snubbing at corners. Conductors need no pounding to force them around sharp bends . . . no stress is built into the coil.

Thus a round coil shape is naturally best, both from the standpoint of efficient winding, and fault-free operation.

3. SIMPLE SURGE PROTECTION



THE KEY to voltage surge protection in an Allis-Chalmers shell type transformer is *overall design* —not shielding. Good voltage distribution is built right into shell type construction.

Allis-Chalmers *does* use a shield, however — an ideally simple disc which is connected to the line and placed next to the line-end turns of the transformer.

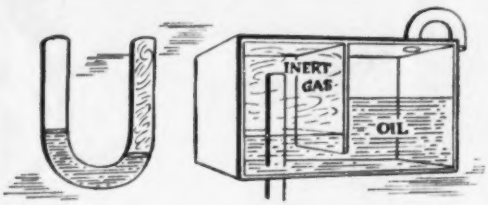
Since the shield is a flat metal plate insulated and installed the same as the coil discs in the transformer, it introduces no points of high stress between the line and distant coil turns. By the same token, it cannot interfere with free oil circulation.

Invest in ALLIS-CHALMERS

Applied Common Sense

than in Power Transformer from ALLIS-CHALMERS Practice:

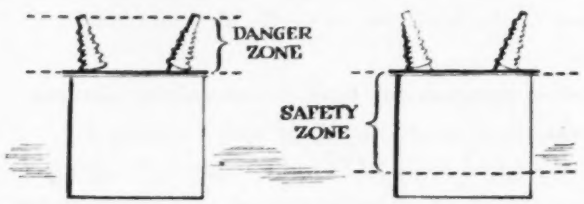
4. VALVELESS INERT GAS REGULATION



IT'S JUST GOOD SENSE to want to avoid a complicated valve system of regulation when you protect transformer oil with inert gas. For this reason, Allis-Chalmers offers you an amazingly simple Oil-Sealed tank, which operates at low pressure, and on the U-tube principle.

The Oil-Sealed system has no reducing valves, no moving parts to wear and cause trouble — *requires minimum maintenance.*

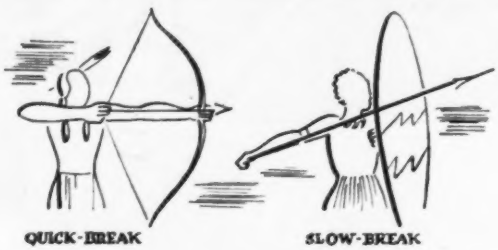
5. OUT OF THE DANGER ZONE



THE SIDE of the transformer tank is both the safest and the most convenient location for no-load tap changer operating handles, so that's where Allis-Chalmers puts them.

With the operating handle and position plate at the *side* of the transformer tank, rather than on the cover, tap positions can be observed from ground level while the transformer is in service It's easy to change tap positions, too.

6. STORED ENERGY FOR QUICK-BREAK ACTION



FAST contact separation means short arcing time, less burning, and consequently longer life for arcing contacts.

That's why Allis-Chalmers designs its power transformer load-ratio-control mechanisms to operate on the quick-break principle of stored energy — which contrasts with slow-break as shooting an arrow contrasts with throwing a spear.

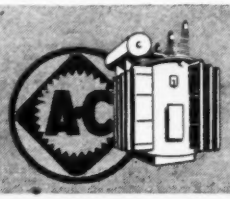
Quick-break action *snaps* contacts from one position to the next, without time for pitting or burning!

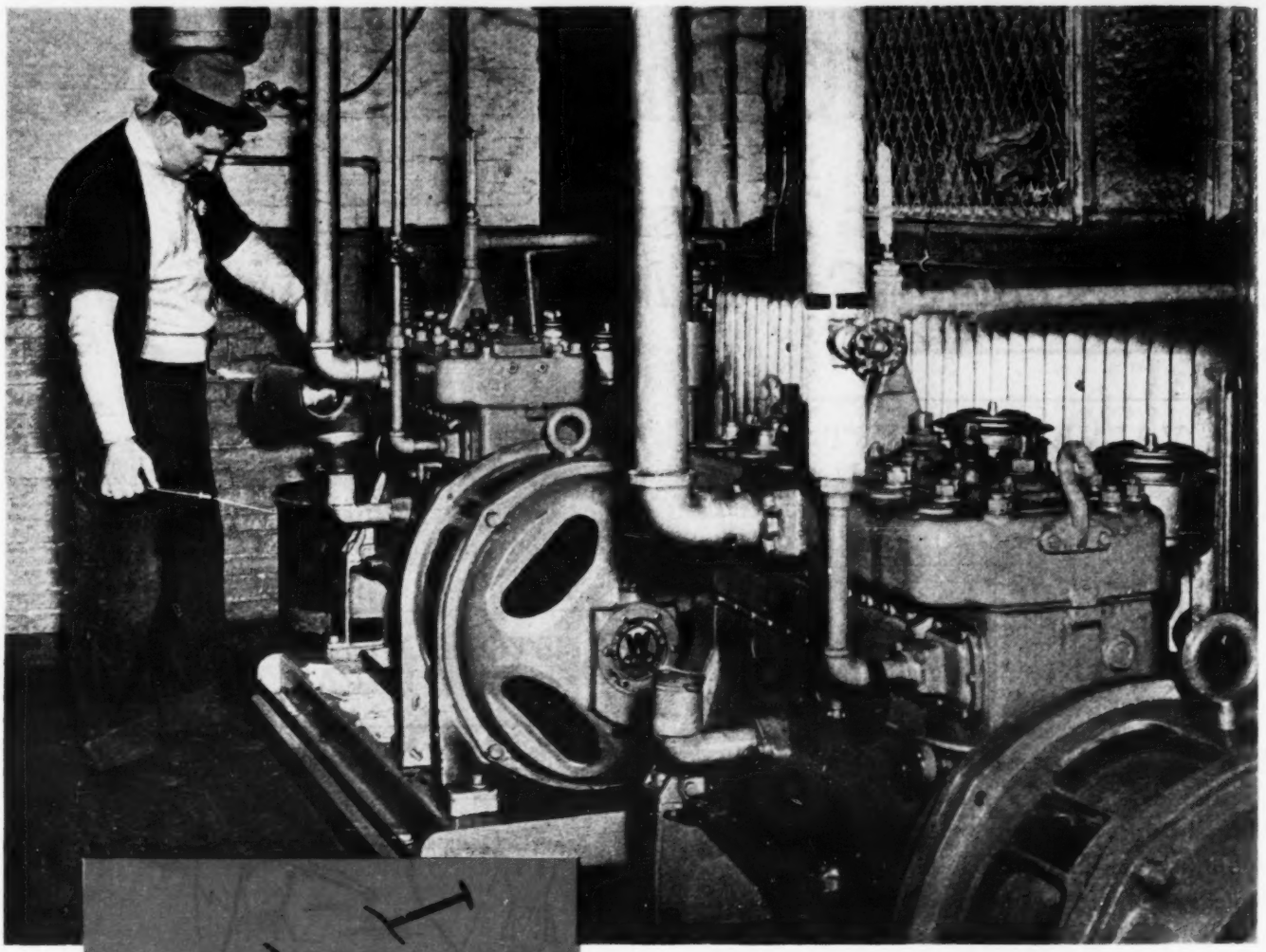
Get the full story on sturdy, reliable power transformers from your nearby A-C district office, or write directly to ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

♪ *Tune in the Boston Symphony, Blue Network, every Sat. Eve.*

A 1791

Power Transformers





YOU SAVE WHEN YOU INSTALL SCHRAMM AIR COMPRESSORS IN UNIT SYSTEMS

Here is an interesting illustration of two Schramm Air Compressors at work, furnishing air in a plant where there is regularly a demand for a medium amount of air—and an *occasional* peak load which requires a lot of electrical current and air. The two compressors take care of the *variation* of needs for much and little air.

Schramm compressors have 3 outstanding features that make them economical and easy to operate: (1) 100% water cooled (2) lightweight and compact (3) vibrationless, even when providing great amounts of air.

These—and many other features—make Schramm Air Compressors the best compressors for your plant. Write today for full data.

SCHRAMM INC.

THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

A modern, low-cost method of centralizing motor control and combining it with an AIR-COOLED Transformer has long been requested by Plant Engineers.

Now—it's here! . . . an air-cooled Power Center as acceptable in appearance as it is in performance. No need to hide *this* unit in a vault . . . either for looks or for safety. Install it anywhere indoors without fireproof vaults.

A Westinghouse Power Center is a completely co-ordinated unit substation, factory-assembled and tested, and delivered to your plant ready to be connected for service. It consists of:

A HIGH-VOLTAGE SECTION (15,000 volts or less)
A TRANSFORMER SECTION (2,000 kv-a or less)
A LOW-VOLTAGE SECTION (600 volts or less)

By installing this Packaged Power *at* load centers, you'll save as much as 75% of the copper required for secondary runs and improve voltage regulation. Ask your Westinghouse representative for details. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N. J-70431

IT'S HERE

A SMART LOOKING, NEW *Air-Cooled* POWER CENTER

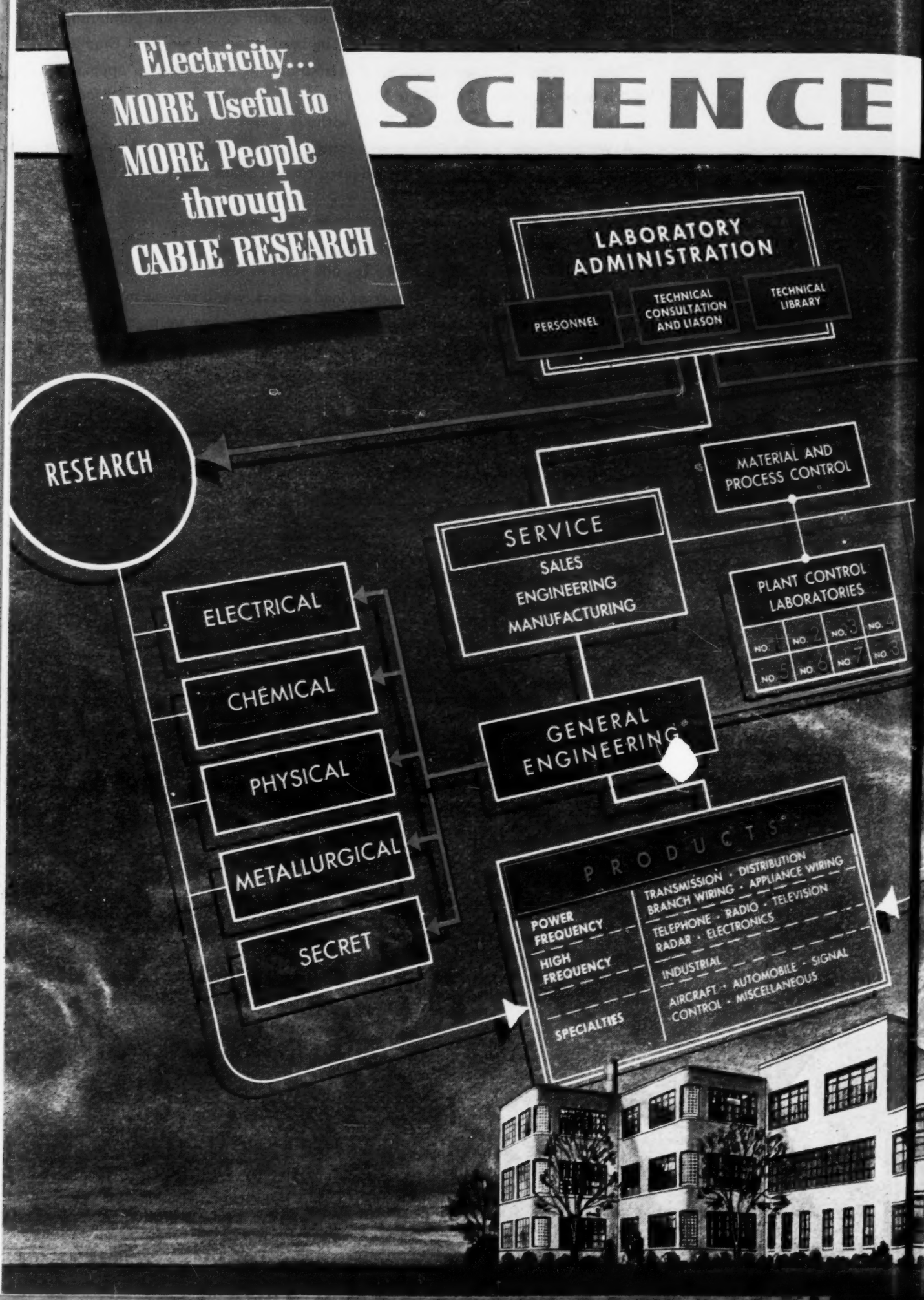
Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

PACKAGED POWER

SCIENCE

Electricity... MORE Useful to MORE People through CABLE RESEARCH



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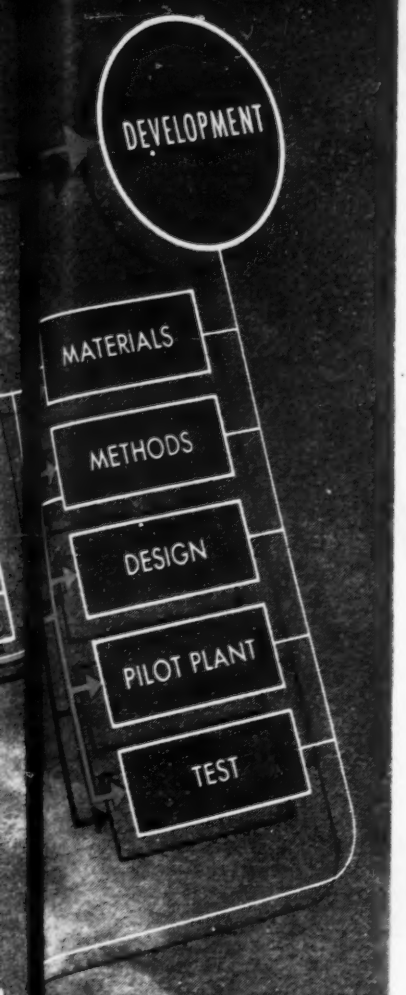

The General Cable Research Laboratory is by no means an end in itself. The great, new building, its facilities and scientific equipment are but an impressive and efficient tool in the hands of the men who are bringing into being this Company's far-visioned industrial program.

Here, pure and applied research go hand in hand with product development, to extend the use of electricity more usefully to more and more people. The achievements now in the making and the achievements of tomorrow will complement the substantial advances already "on the record", by virtue of which General Cable has won and maintained its position in the industry. Research is the spearhead of progress.

GENERAL CABLE CORPORATION

Manufacturers of Bare and Insulated Wires and Cables for Every Electrical Purpose

"JOB PROVEN"
by Linemen the World over

Completed Nicopress joint on line wire.

Nicopress Reducing Sleeve for splicing wires of different sizes.

Rugged, easy-to-operate Nicopress tool for making perfect line splices.

Nicopress Repair Sleeve for A.C.S.R.

Nicopress Suspension Dead Ends for use with disc insulators.

The National Telephone Supply Company

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Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

THE NATIONAL TELEPHONE SUPPLY COMPANY

On Modern High-Voltage Motor Controls, too—

"EXPERIENCE CHOOSES S & C FUSES"

For dependable short-circuit protection of 2300 and 4600 volt motors, leading controller manufacturers choose S&C High Interrupting Capacity Power Fuses.

Long used on utility and industrial substations, these fuses are now demonstrating their advantages on high voltage motor applications, too.

They provide safe, reliable, short-circuit protection up to 150,000 kva at 2300 volts and to 300,000 kva at 4600 volts, at substantial savings in all-around costs, space, and maintenance.

Motor controller assemblies are equipped with thermal overload relays that prevent possibility of motors operating single-phase.

It will pay you to get the facts.

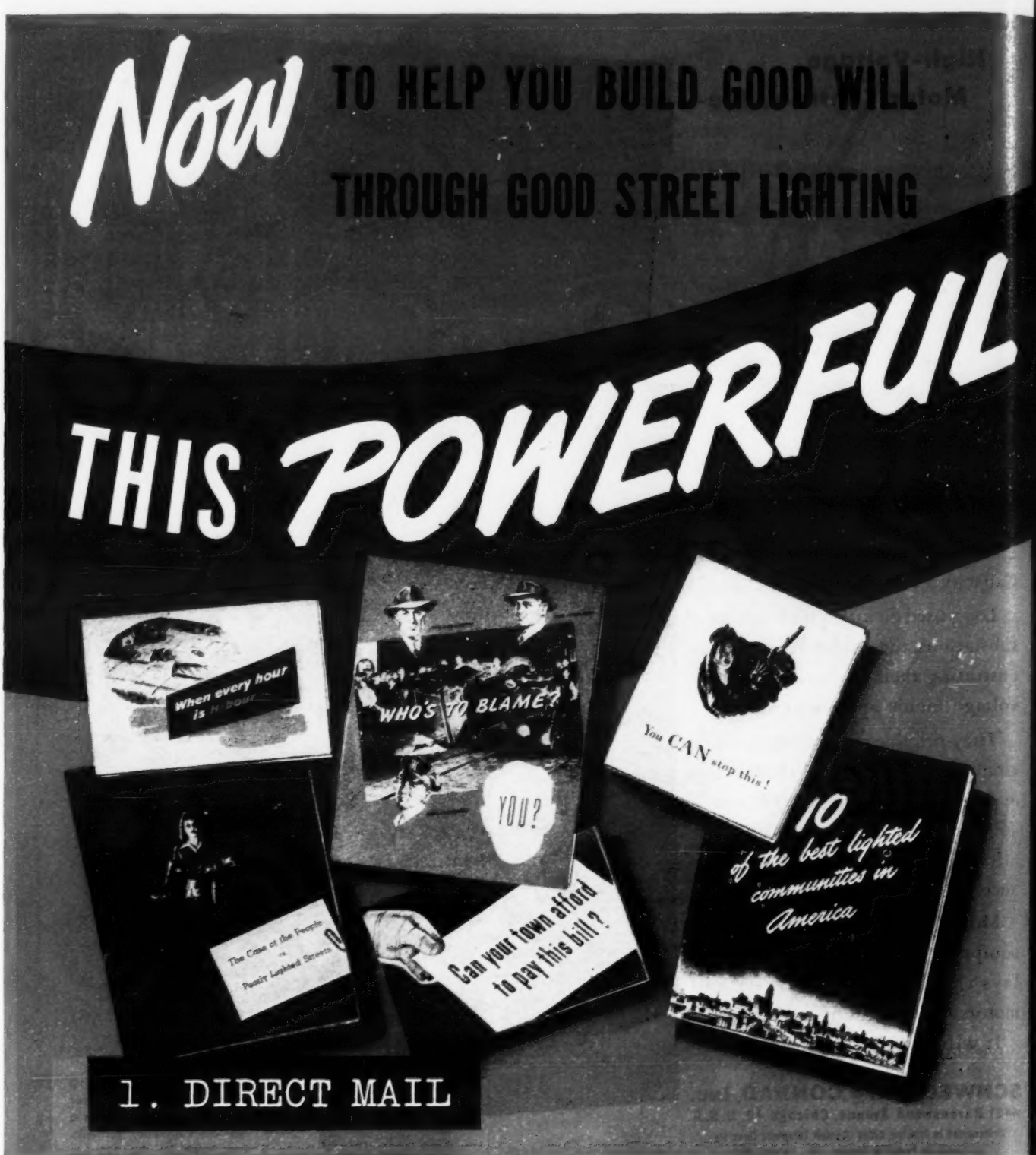
SCHWEITZER & CONRAD, INC.
4421 Ravenswood Avenue, Chicago 40, U. S. A.
Represented in Principal Cities (Consult Telephone Directory)
In Canada by Powerlite Devices, Ltd., Toronto, Ont.

S&C High Interrupting Capacity Disconnect Power Fuses incorporated within a typical magnetic, full-voltage, controller for 150 hp, 3-phase, 60-cycle, 2200 volt squirrel cage induction motors.

Get New Bulletin 242. Details modern motor short-circuit protection. Send for it today.

HIGH INTERRUPTING CAPACITY POWER FUSES

Dependable protection for high-voltage motors


Now TO HELP YOU BUILD GOOD WILL
THROUGH GOOD STREET LIGHTING
THIS POWERFUL
When every hour is hour
WHO'S TO BLAME?
YOU?
You CAN stop this!
10 of the best lighted communities in America
The Case of the People vs Poorly Lighted Streets
Can your town afford to pay this bill?
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HERE, *for the first time,* is a complete set of street lighting sales promotion materials . . . geared to your local needs, yet tied in with a nation-wide advertising campaign. Best of all, it's available to you now . . . ready for use . . . at small cost.

This effective material, shown in part on these pages, includes:

1. A six-piece direct mail campaign, aimed at municipal officials and other civic leaders, and designed to pave the way for you to sell improved postwar street lighting to the communities you serve. Each piece features a different appeal . . . civic pride, accident prevention, protection of women and children, economy . . . yet each covers all basic sales points. Well-illustrated with dramatic art work and before-and-after photographs. Attractive colors, at least two to each piece. Varying shapes and folds to lend variety. Sizes from 5½ x 8½ inches to 8½ x 11 inches. May be imprinted with The Street and Traffic Safety Lighting Bureau's signature or your own. Price: 45 cents per set of six—less 10% for orders of 100 sets or more.

2. A dramatic window display, aimed at the business man, the car driver, the parent—the *responsible citizen,* and designed to help win his approval of your postwar street lighting modernization plans. Appropriate for use in your lobby, your show windows, or other strategic locations around town. Reproduced in three colors—red, yellow, and blue. Size—35 x 45 inches. Fitted with double-winged easels and packed in

ADVERTISING CAMPAIGN *all ready for your use*

before
WHAT HAPPENS WHEN A CITY LIGHTS UP
after
NOW AND THEN A CHILD IS CRIPPLED
TRAFFIC ACCIDENTS DOWN 30%
SHOPPERS CALL IT A 7 O'CLOCK TOWN
3. MOVIE SHORT
2. WINDOW DISPLAY
GOOD STREET LIGHTING – THE SIGN
TO LIVE
All Backed by
NATIONAL ADVERTISING
Already appearing monthly in national publication space to pre-sell your municipal contacts.

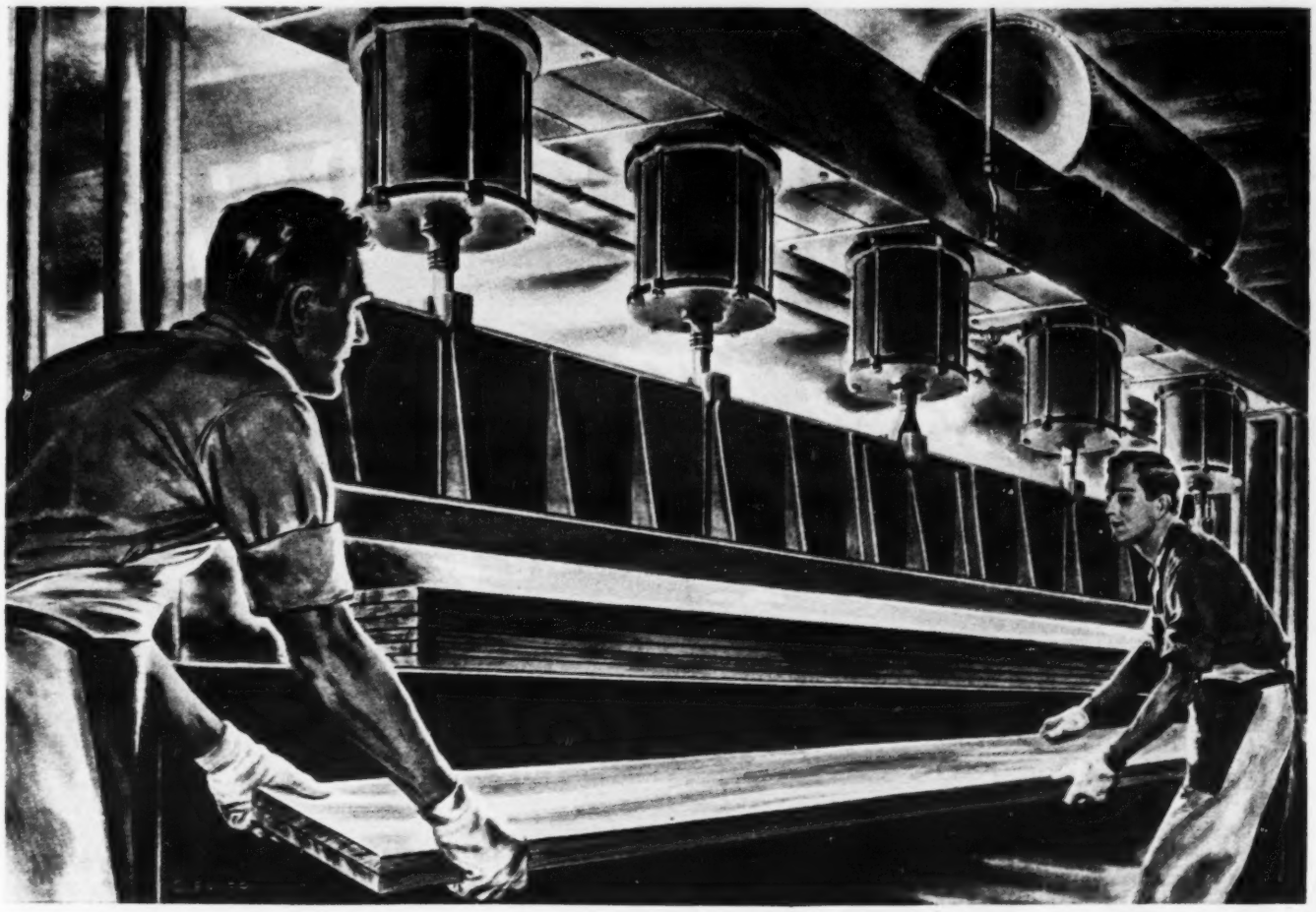
individual cartons. Price—$3.50 each, plus postage.

3. A movie short, also aimed at the general public and designed to win support for your plans and activities is scheduled for early production. Entitled "Doomed by Darkness", it shows the fate that might overtake anyone on a poorly-lighted street, dramatizes in a thrilling minute-and-a-half the need for adequate street lighting. Endorsed by prominent public safety officials. Recommended for use in neighborhood theaters or at P-TA meetings. Exceptionally low price on request.

Act Now!

Capitalize on the national advertising campaign, sponsored by The Street and Traffic Safety Lighting Bureau, which is urging municipal officials to write *adequate street lighting* into their postwar plans. Make full use of these effective sales promotion materials. Order all you need NOW. The Street Lighting Section of NEMA, 155 E. 44th St., New York 17, N. Y.

GOOD STREET LIGHTING BUILDS GOOD WILL



How RCA Electron Tubes Speed Wood Bonding 700%

Electronic Heat Helped Tolerton Lumber Co. Multiply Production of Wooden Aircraft Members.

A CRITICAL shortage of Grade A spruce of adequate size threatened to limit manufacture of wood aircraft.

As solid planks from which wing spars were cut became harder and harder to find, manufacturers resorted to ingenious bonding together of easily available, random pieces, but production time and costs increased sharply.

To lick this new problem, the Tolerton Lumber Co., Alliance, Ohio, applied electronic heating.

They developed methods by which electronic heating "set" glued joints in 2 minutes . . . instead of hours as formerly required by cold-setting. They found that it took only 20 minutes for electronic heat to bond several planks into a laminated 6" x 6" x 16½' beam . . . as against 4 hours in a hot-platen press!

Electronic heat at Tolerton is provided by an RCA 16-kw electronic generator, in which power from the commercial supply is converted from a frequency of 60 cycles to 10 million cycles. Two RCA Type 892-R oscillator tubes and six RCA Type 872-A/872 rectifier tubes are used.

Results:

1. The Tolerton plant output jumped from 25 to 200 spars per day, because of shortened press time.

2. The setting of the glue is complete, because electronic heating produces uniform temperature throughout the glue line.

3. Lumber costs were cut about 40% by use of odd pieces.

4. In tests, the joints proved stronger than the wood itself 100% of the time — well above the government specifications.

Other Applications By Tolerton: Mr. R. I. Tolerton, Vice President of the Tolerton Co., reports that "we are also using this electronic method of gluing in the manufacture of lithograph backing blocks, steel-mill hammer boards, and 6-inch square maple blocks, which are later turned to make wheel-bearings for bombers. In each case the result has been important savings in time and expense, and more accurately made products because of the better glue adhesion obtained by electronic heat."

For Further Information on the Tolerton operation, send for free 8-page article, "Electronic Heating Sets Glue in Laminated Aircraft Spars." For examples of electronics at work in our own factories, send for the free 32-page booklet, "Electrons in Action at RCA." Address all inquiries to RCA, Commercial Engineering Section, Dept. 62-50W, Harrison, N. J. If you have any problem involving the use of electron tubes, RCA tube-application engineers will be glad to help you or to put you in touch with a manufacturer who can.

Remember, the Magic Brain of all electronic equipment is a tube . . . and the fountainhead of modern Tube development is RCA.

BUY MORE WAR BONDS

RCA

42-4334-50

RADIO CORPORATION OF AMERICA

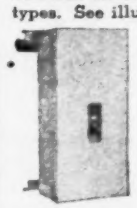
RCA Victor Division • Camden, N. J.

CHANGING the PLANT LAYOUT?

IF (FA) BUSDUCT distribution for light and power is already installed, it will be a simple matter to adjust it to new requirements. It is practically 100% recoverable.

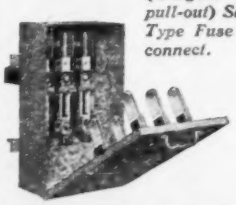
(FA) PLUGIN DEVICES

The (FA) Plugin Devices can be arranged to go on either or both sides of the Plugin (FA) Busduct, and each Plugin device is supported by independent fastenings. All (FA) Plugin Devices are equipped with proper capacity of rugged compression type bus bar connectors. They are made in three types. See illustrations below:



At left: (FA) Circuit Breaker Type.

Below: (FA) Klampswitchfuz (hinged type pull-out) Safety Type Fuse Disconnect.



Above: (FA) Shutlbrak (operating Switch) with Kamklamp Fuse Holders.

Or, consider the conveniences and economies of this modern system in *new* planning... Feeder (FA) Busduct is ideal for large capacity connections between generators (or transformer station) and main switchboard, and between the latter and the feeder distribution system to the various parts of the building ...Plugin (FA) Busduct affords great flexibility for machine layout. The plugin outlets spaced on 12-inch centers, make it possible to locate machines at any desired position, and to plug in quickly at the most convenient outlet—with minimum loss of production hours... Both Feeder and Plugin types are made in standard 10-foot sections. Suitable elbows, tees, cross connections, intermediate feed-in and feed-out boxes, end closures with surge discharge protectors, and reducing capacity sections, make it possible to fit (FA) Busduct to any desired arrangement. It is adaptable to any required position or location... Extensions may be made readily to existing systems, without disturbing them, and at minimum labor cost... Installation of (FA) Busduct is economical for small plants, as well as large.

Designed for 2, 3 and 4-wire feeder systems; 250 volt DC, 575 volt AC, maximum. Capacities in accordance with Limitation Order L-273.

Write for Bulletin 65

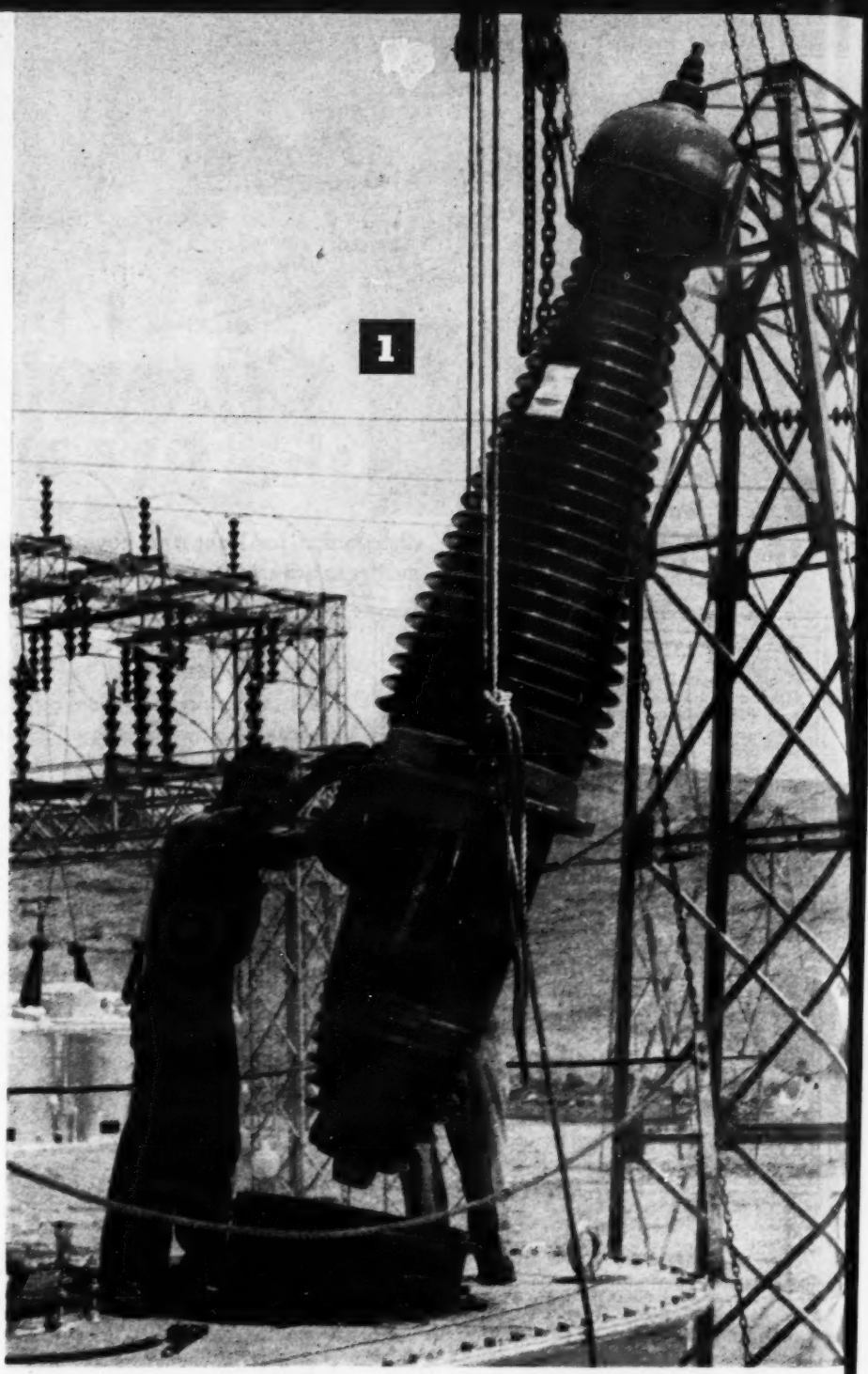
Also for name and address of nearest (FA) Sales-Engineer. Whether revamping the distribution system, or installing a new one, his long experience will be helpful to you ... Frank Adam Electric Co., Box 357, St. Louis 3, Mo.

Frank Adam
ELECTRIC COMPANY
ST. LOUIS

QUESTION: *Can You Specify*

THE ONE THING THAT YOU REALLY WANT

in an insulator - - - - - - - - - - - - - *any* insulator?



Be it a suspension, a pintype, a switch insulator, a bushing – it makes no difference – M & E values are established.

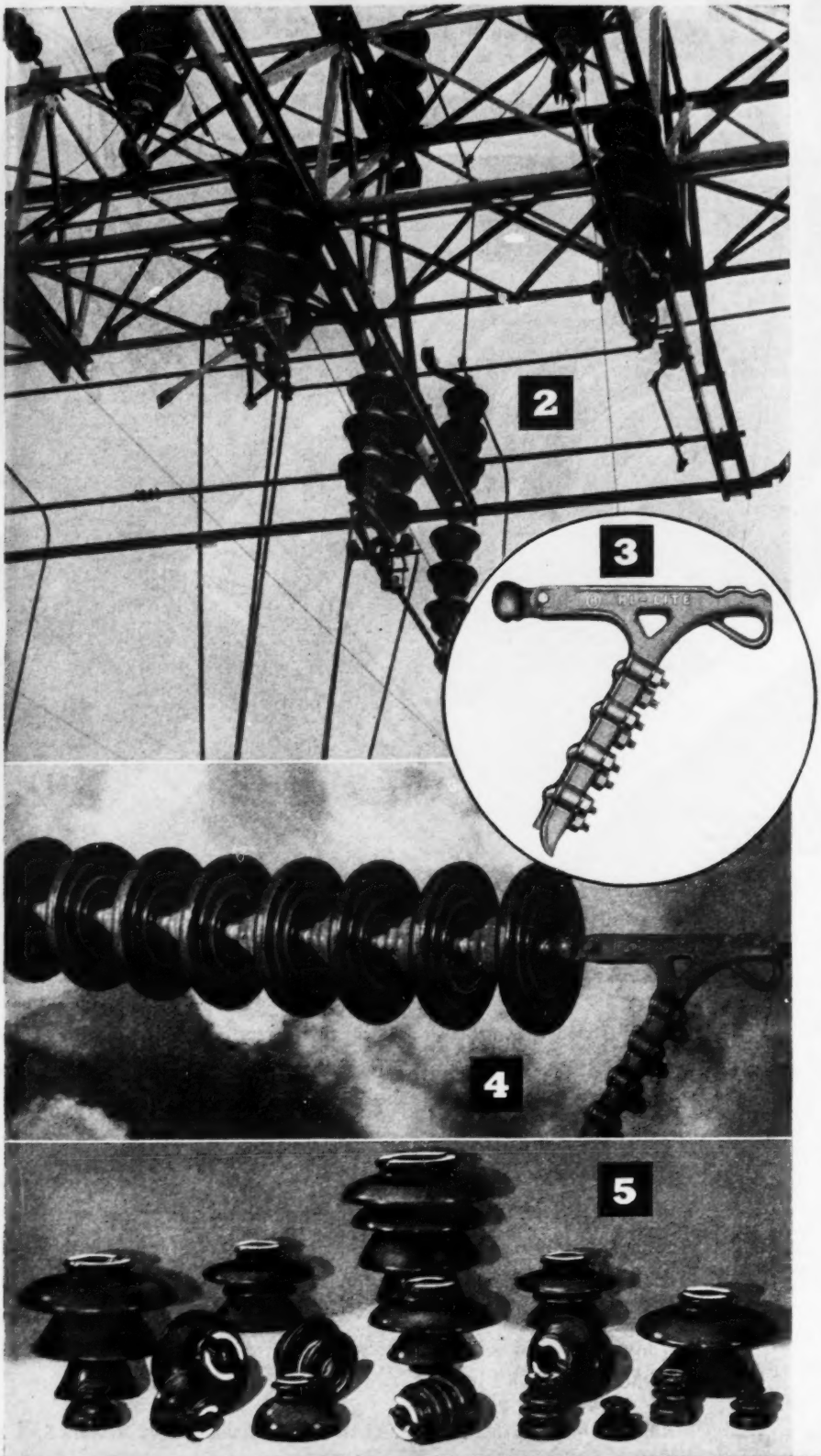
When it comes to those things covered by specifications, you are dealing with strictly tangible factors.

But when you recommend a piece of insulation for your system, you assume M & E ratings and quickly go on to a much bigger question – how well and how long will these insulators stand up in service?

Here are a few of O-B's concrete answers to that question.

YOU TRUST PORCELAIN – Power men have learned from broad experience to trust porcelain insulation – it remains unaffected by almost any operating hazard. Inside O-B bushings, the inherent stability of porcelain insulation is protected and reenforced by the presence of oil, and it has been sealed off from exposure. These bushings have a ruggedness and an ability to stand up under extreme demands that has actually established a new standard for bushing performance. They require a minimum of attention or out-of-service time for maintenance. O-B bushings give you reliability where it is really appreciated.

ALL ALIKE – ? Nowhere do the "undefinable" elements of an insulator play as prominent a part as in switch and bus service. So many rigid standards are established that it has sometimes been assumed all differences have disappeared. But, again, M & E specifications are at best only indicators of re-



liability – a quality that must be imparted to the insulator by experience and manufacturing skill that defy definition. O-B can offer proof of accomplishment here in the form of both the most extensive and the oldest service records in the industry. Facts like these can't be denied.

CORRECT MATERIAL – More important than any one hardware design or single feature is the fact that O-B has its own foundries and forge shops; making a choice of material or manufacturing method no handicap to the designing engineer. He has no restriction placed upon his ideas – the facilities are at hand to interpret them to best advantage. Malleable iron, steel, brass, aluminum, can all be utilized where their characteristics are best applied. As an insulator manufacturer, O-B has an exclusive advantage in the extent of its metal fabrication facilities. This advantage shows up in the service of O-B hardware.

MINIMUM STRENGTH – Because suspension insulators perform as links in a chain, individual strength is the only correct criterion of reliability. On this account, O-B was the first to establish a minimum strength rating, made possible by highly perfected manufacturing control. With O-B, you get the kind of strength that counts, because you can count on it! You can't specify all the little things that add up to this big improvement – you don't have to. Simply put "O-B" on your order.

CRITICAL SERVICE – Any pintype interposes only one dielectric barrier between potential and ground. Many lines have the added operating hazard of no shielding. If it can be said that one kind of insulator must be better than any other, that kind is a pintype! Recognizing this, O-B has always emphasized the finest possible quality even in the smallest pintype models, and has never allowed them into become the "stepchild" of larger, more expensive insulators. O-B pintype-insulated lines that are now finishing their second world war offer proof of this. No set of formal specifications can define those things that produce such reliability, but "O-B" on your order will secure it for you.

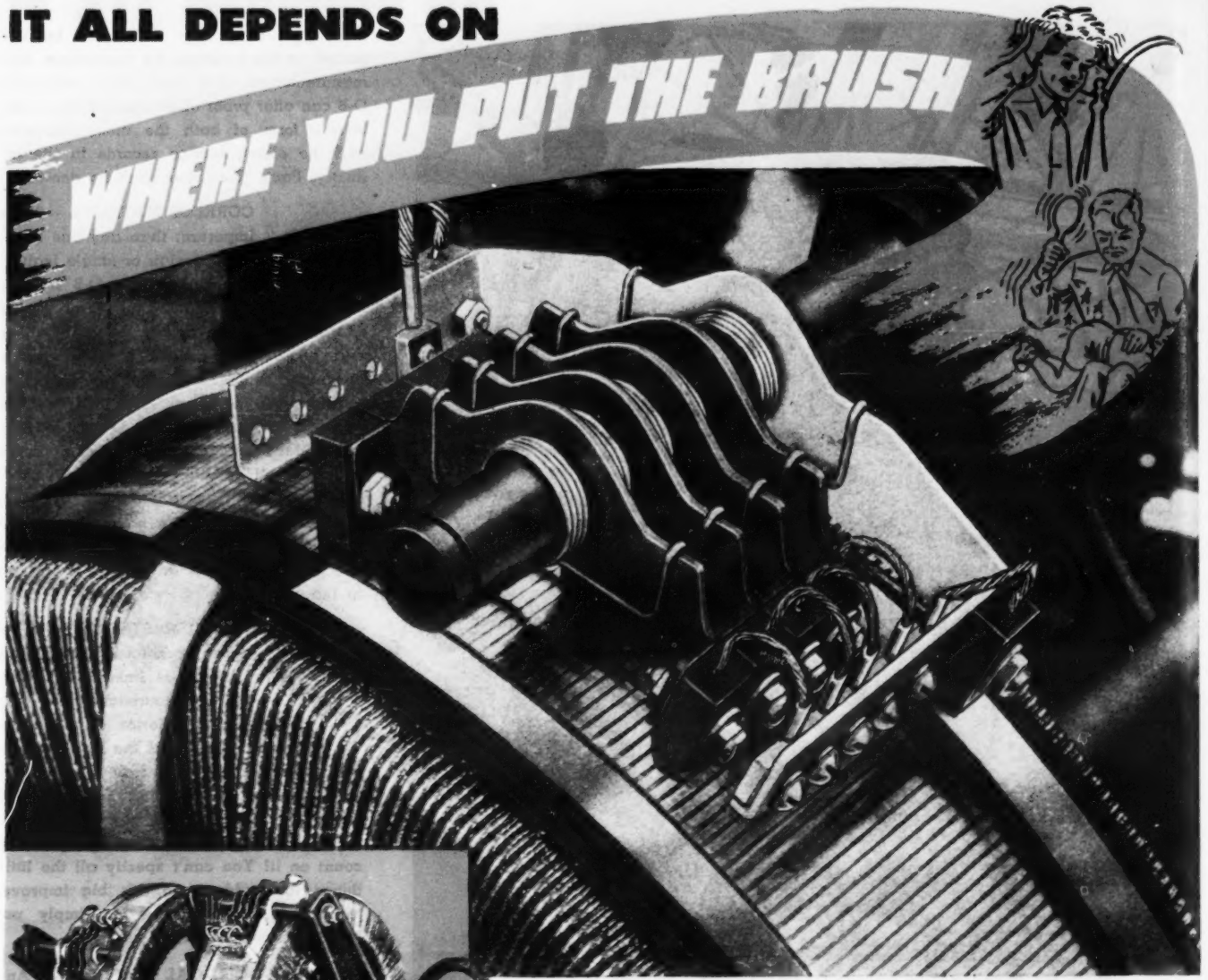
Ohio Brass

MANSFIELD, OHIO, U.S.A.

2593-H

CANADIAN OHIO BRASS COMPANY, LIMITED, NIAGARA FALLS, ONTARIO

IT ALL DEPENDS ON WHERE YOU PUT THE BRUSH



11.5 KVA, single phase, 50/60 cycles, input 115 Volts, output 0-115 Volts, 100 Amps.

Topside or bottom—a hair brush can be applied effectively at either place according to the result desired. But the commutator brush on an a.c. voltage regulator is different. Only **one** place will do for best results and that is where the Transtat's brush track is.

Instead of on the commonly used flat annular section, where brush area is limited, the Transtat brush rides on the curved outside surface of the coil. There, the uniformly laid wires permit grinding smooth, perfectly parallel, evenly spaced commutator segments. That means arc-less, practically stepless control without circuit interruption. This position allows room for the long, sturdy Transtat brushes with their larger heat dissipating surfaces and lower current density per contact area . . . cooler running, longer lasting brushes.

Being transformer type regulators, Transtats will not distort wave form or alter power factor. Their varnish-impregnated cores and coils cannot loosen in service. The balanced collector arms maintain brush setting in any position. For continuous a.c. voltage regulation in testing, heating, plating, light control, speed control and in radio transmitters and other electronic apparatus they are unexcelled. Write for bulletin 51-2.

AMERICAN TRANSFORMER COMPANY · 178 Emmet Street, Newark 5, N. J.

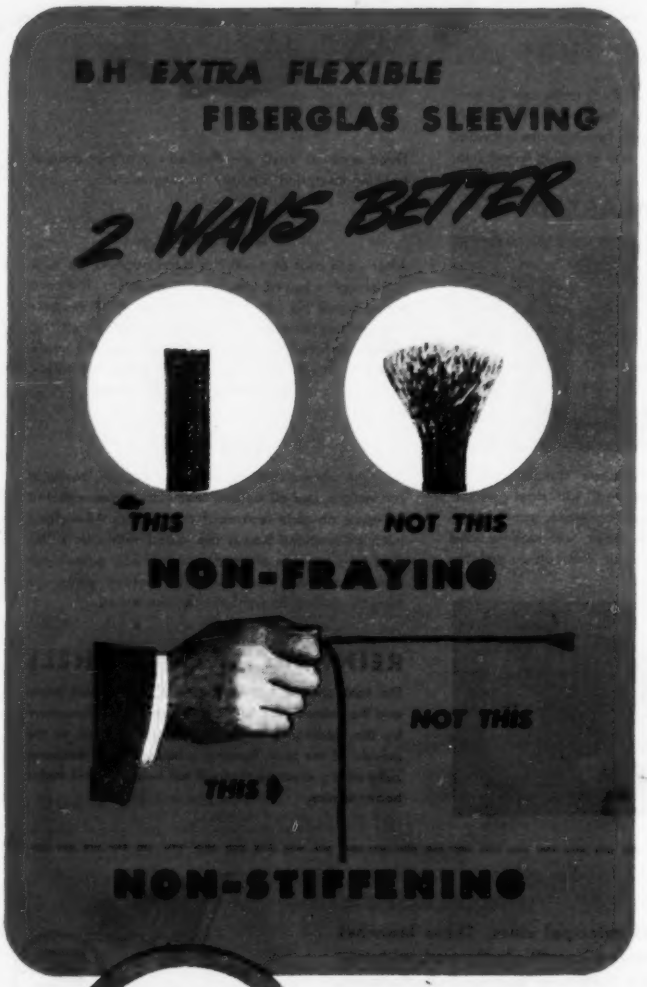
AMERTRAN

MANUFACTURING SINCE 1901 AT NEWARK, N. J.

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

AMER-TRAN

BH NON-FRAYING FIBERGLAS SLEEVING



INSERTING bare wire in rough sleeving that frays out on the ends is time- and patience-consuming. The job is much simpler and less irksome when you use BH *Extra Flexible* Fiberglas Sleeving, the non-fraying, smooth bore insulation that takes fine-stranded wires without a hitch.

Special-processed BH Sleeving is *permanently* flexible and non-fraying. It won't harden and crack with age, and it won't burn. In addition, it has all the other desirable electrical and physical features of inorganic Fiberglas.

If you're looking for an easy-working, long-lasting insulation, why not try BH *Extra Flexible* Fiberglas Sleeving? It's available in all standard colors and sizes from No. 20 to 5/8", inclusive. Write for samples today!

BH SPECIAL TREATED FIBERGLAS SLEEVING CUTS CLEAN, DEFIES HEAT

Here's another high quality BH Fiberglas Sleeving. No saturant is used in the exclusive BH process, yet the sleeving will not fray when cut and withstands heat up to 1200° F. Made in natural color only—all standard sizes. Try it!

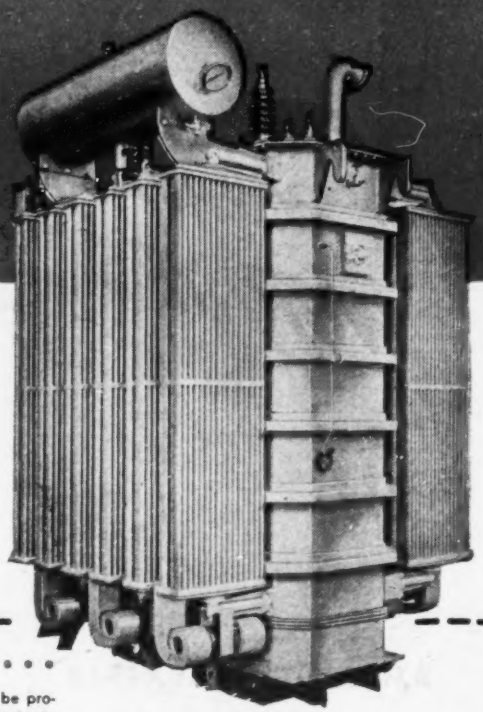
BH PRODUCTS

SLOW-BURNING IMPREGNATED MAGNETO TUBING · SLOW-BURNING FLEXIBLE VARNISHED TUBING · SATURATED AND NON-SATURATED SLEEVING

BENTLEY, HARRIS MANUFACTURING CO.

Dept. W Conshohocken, Penna.

Wagner
POWER TRANSFORMERS
are sturdy and rigid . . . assuring users *plus* construction—



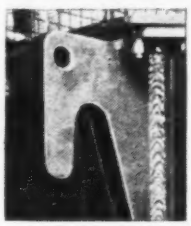
In the past 50 years, Wagner power transformers have established outstanding performance records in supplying dependable and unfailing continuity of service.

Carefully controlled production methods . . . Highest quality materials . . . Rigid inspections and tests . . . Engineering experience . . . all combine to give Wagner power transformers the ability to take real punishment and still stay on the job.

Illustrated and described below are some of the construction features that make these transformers the "huskies" of the power industry.

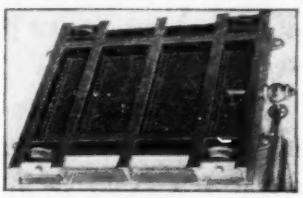
STUDY THESE CONSTRUCTION FEATURES . . .

WELDING



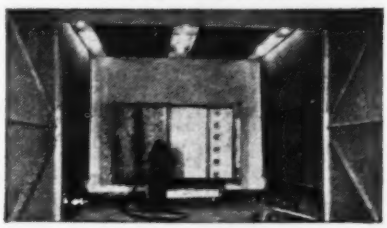
All seams are electrically welded inside and outside, and in some of the larger tanks a total of four welds are used to assure strong, leakproof joints. Note the heavy steel lift hooks. They are solidly welded to the transformer just below the top section of tank. The holes in the lugs provide a means to attach cables to assure safety in shipment.

BASE CONSTRUCTION



The base is formed from exceptionally heavy steel-plate. On small tanks, the base is folded and welded to furnish the under-support. On large tanks, heavy structural-steel channels and angles are welded to the sheet-steel base. When specified, tanks can be provided with wheels or trucks, flanged or flat wheels, railroad-gauge or otherwise. Tow lugs are provided on two sides of the base to permit pulling transformer into position.

SAND BLASTED



After the welding operations are completed, each transformer tank is "sandblasted" with steel grit. This removes all plate and welding scale, providing a clean, solid base so the paint will adhere and thoroughly cover both the inside and outside surfaces of the transformer.

FLOW COATED

The tanks of all Wagner power transformers are flow-painted. This process assures complete coverage with a uniform coating of paint. Three coats of paint are applied—a primer coat, a bonding coat, and a heavy finishing coat.

BAKED

After each coat of paint has been applied the tank is thoroughly baked in special bake ovens. The care taken in painting and baking the tanks of all Wagner transformers assures an absolute weather-resisting outside surface. The special paint used on the inside of the tanks will not disintegrate or act as a catalytic agent to cause transformer oil to deteriorate.

TESTED

All tank covers, bushing mounting-flanges, radiator connections, and all welded seams are pressure-tested to insure absolute leakproof construction. All welded joints of mounting bosses are tested with a very thin fluid at a pressure of approximately 350 pounds per square inch. Any defects in the welded joints are thereby quickly and unfailingly discovered.

REINFORCED TANK SHELL

The tank shell is fabricated from heavy steel plate and the entire tank body is given added reinforcement by the addition of structural shapes welded to the outside of the tank, forming a homogenous, mechanically strong structure that will not twist or bend under heavy strains.

TRANSFORMERS
are but one of several WAGNER PRODUCTS serving industry.

Other WAGNER PRODUCTS:
AIR BRAKES
BRAKE LINING
HYDRAULIC BRAKES
INDUSTRIAL BRAKES
INDUSTRIAL BRAKE CONTROLS
TACHOGRAPH (Recording Speedometer)
ELECTRIC MOTORS

Write for Complete Information

Wagner maintains branches in 29 principal cities. These branches are manned by trained field engineers who will gladly work with you and show how you can benefit by installing Wagner Transformers.

T45-2

Wagner Electric Corporation
ESTABLISHED 1891
6456 Plymouth Avenue, St. Louis 14, Mo., U. S. A.
ELECTRICAL AND AUTOMOTIVE PRODUCTS

The Truck with a

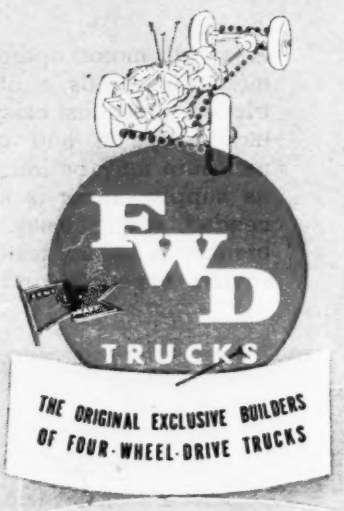
$50,000,000.00 ENDORSEMENT

FWD's MODEL HAR

A truly great truck — the FWD Model HAR—a truck that in just four years has won the endorsement of motor truck users to a total of $50,000,000 in purchases of this single model—a truck that has achieved the phenomenal record of $50,000,000 in manufacturing experience in the comparatively brief span of 48 months.

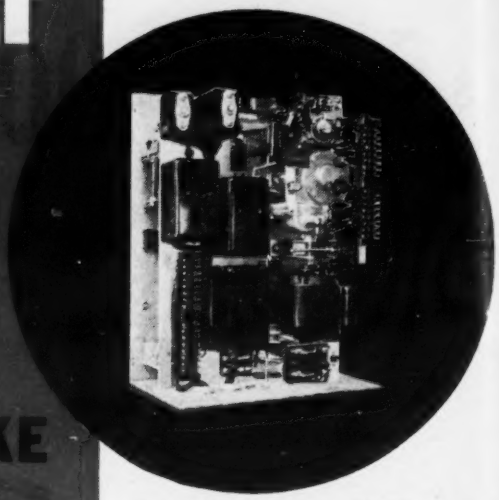
Rated at 20,000 lbs. gross, the Model HAR embodies the highest development of the four-wheel-drive principle, pioneered and sponsored by FWD since 1910. Truck operators know that the true four-wheel-drive principle as applied in FWD's gives these trucks a basic mechanical advantage—qualifies them to get through regardless of road or weather—to go with greater safety — to perform year after year at lowest cost per ton mile — to conserve war-precious gas-oil-tires-replacements. When the call is for rugged, dependable trucks to provide vitally important motor transport, your confidence is well placed in FWD's.

THE FOUR WHEEL DRIVE AUTO CO.
Clintonville, Wisconsin
Canadian Factory: KITCHENER, ONT.



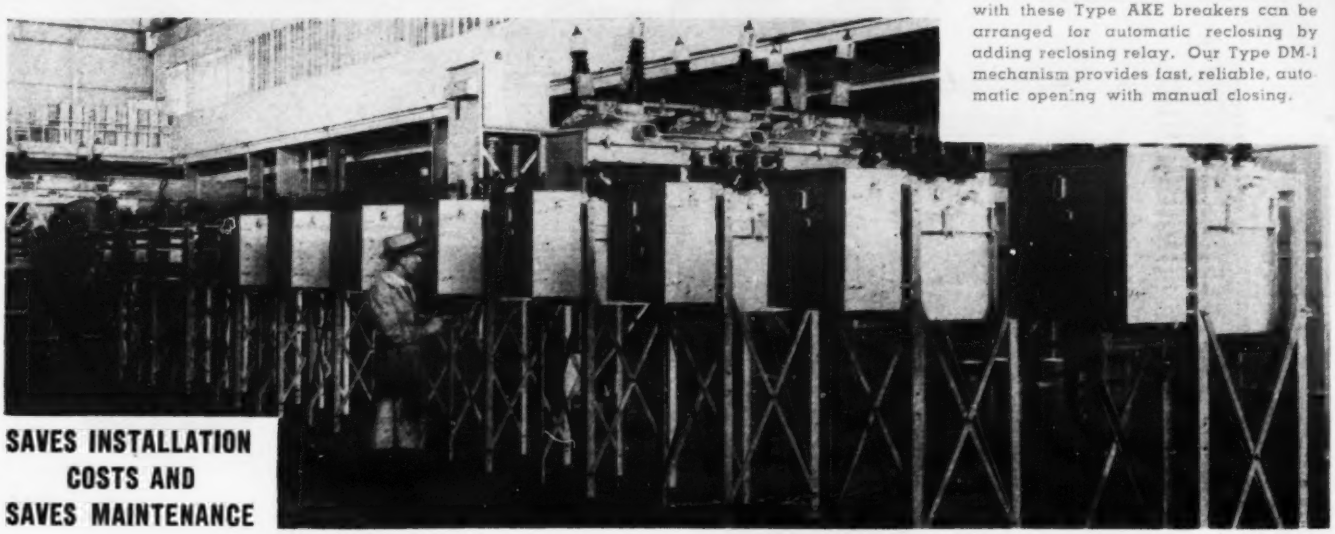
Here's FAST FAULT CLEARANCE for Distribution CIRCUITS to 15 kv. inc.

PACIFIC ELECTRIC TYPE AKE OIL CIRCUIT BREAKER . . . .



Reclosing Motor Mechanism

The Type MJ-1 Motor Mechanism used with these Type AKE breakers can be arranged for automatic reclosing by adding reclosing relay. Our Type DM-1 mechanism provides fast, reliable, automatic opening with manual closing.



SAVES INSTALLATION COSTS AND SAVES MAINTENANCE

Shop View of Type AKE-25, 7.5-kv., 400 and 600 amps. Made also in Type AKE-40, 15-kv., 600 amps. Both 50,000 kva.

THIS breaker has proved reliable for fast fault clearance on utility lines the nation over, and its Spring-Operated Motor Mechanism, an exclusive feature, provides for fast and constant closing speeds.

A small motor operating on AC or DC automatically winds a strong spring which, when tripped, gives fast closing. Any number of reclosings may be had on transient faults. First reclosure may be immediate. For AC operation, its supply circuit is simple as no rectifiers are needed, saving installation costs. Moreover, the breaker is factory tested and shipped assembled, saving expenses and time during installation.

Equipped with the Pacific Electric Expulsion Contacts, arcs extinguish instantly, clearing the circuit quickly and permitting fast reclosing. Fast arc extinguishment saves contacts, oil and upkeep.

Ask for full details on the sound design of this "AKE" Pacific Electric Breakers.

●

C. H. Cutter, 1015 Securities Bldg., Seattle 1, Wash.
G. B. Kirkwood, 437 S. Hill St., Los Angeles 13, Calif.
J. E. Redmond Co., 448 W. Madison St., Phoenix, Ariz.
Pierce G. Fredericks, 90 West St., New York 6, N. Y.
R. Ackerman, 318 Dooly Block, Salt Lake City 1, Utah
C. C. Musgrove, 508 Insurance Bldg., Dallas 1, Texas

Other Representatives in Principal Cities

Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO 24, CALIF. P. O. BOX 419, GARY, INDIANA

CONSIDER PEDIGREE where QUALITY COUNTS

Nichrome

. . . the Quality resistance alloy made *ONLY* by Driver-Harris

45 years of continuous research devoted entirely to the perfection of the *World's finest resistance alloy* . . . that is the pedigree of NICHROME*.

For just as champions are created through selective scientific breeding, so do Driver-Harris Engineers, by means of perfected melting, hot rolling and cold finishing processes and exclusive quality controls, succeed in producing the champion of all heat and oxidation resisting alloys—NICHROME.

Although there are several excellent Nickel Chromium combinations, there is *only one* NICHROME and it is made *only* by Driver-Harris.

So put the "stamp of quality" on your post-war products by assuring dependable performance and longer life with NICHROME and other D-H resistance alloys.

*Trade Mark Reg. U. S. Pat. Off.

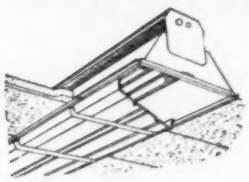
D H — SPECIAL PURPOSE ALLOYS SINCE 1888

Driver-Harris
COMPANY
HARRISON, NEW JERSEY

ARMY E NAVY

BRANCHES: CHICAGO • DETROIT • CLEVELAND • LOS ANGELES • SAN FRANCISCO • SEATTLE

But *applications* unlimited as the architect's ingenuity!



Miller fluorescent lighting systems for schools, stores and offices . . .

are *more* than the finest lighting that engineering can provide. They also open new vistas in esthetic design and functional planning.

For the Architect, Miller fluorescent lighting system applications are practically unlimited. They are equally harmonious and practicable as single units, blocks of units, in geometric patterns—and even as light-strips "by the mile".

The wide range of plastic and glass dishes . . . prismatic glass plates . . . metal or plastic grilles . . . offer still further decorative possibilities for any type interior—or can even create a theme around which the entire interior may be planned.

For the Engineer, exclusive Miller features such as continuous wireway channels (just like in the Miller Industrial 50 and 100 foot Candlers), patented brackets and other improvements make this the most practicable and economical lighting system with which to work.

For Example: Using the Miller method, "fixtures" are *not* hung from the ceiling—but the *ceiling* is hung from the *lighting system!*

There is much more to the fascinating story of Miller fluorescent lighting systems—so call a Miller Representative (they're in principal cities)—and see what our 100 years' work with all proven light sources has taught!

THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent
Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

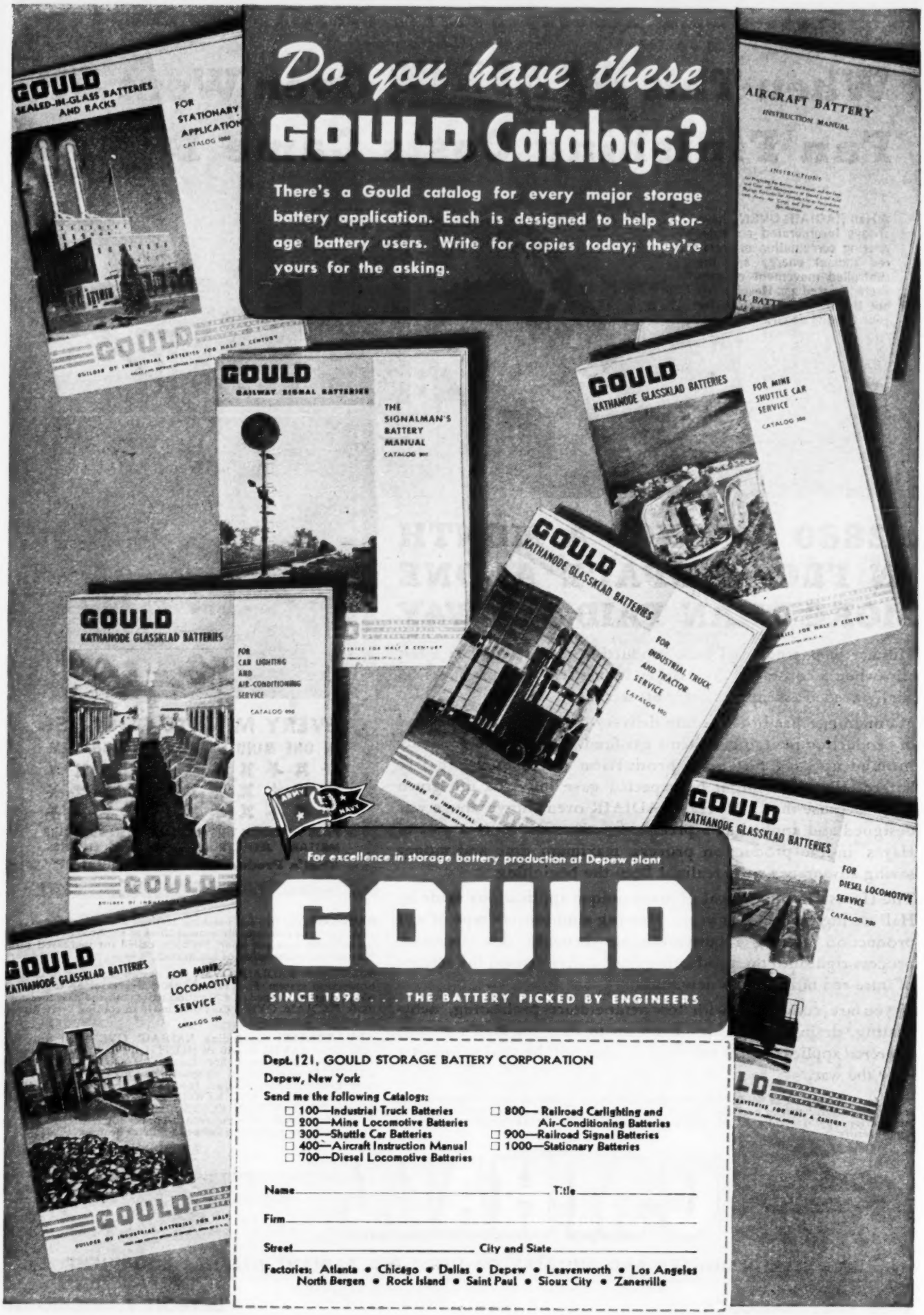
ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Materiel

MILLER
SINCE 1844

Do you have these GOULD Catalogs?

There's a Gould catalog for every major storage battery application. Each is designed to help storage battery users. Write for copies today; they're yours for the asking.



For excellence in storage battery production at Depew plant

GOULD

SINCE 1898 . . . THE BATTERY PICKED BY ENGINEERS

Dept. 121, GOULD STORAGE BATTERY CORPORATION
Depew, New York

Send me the following Catalogs:

- ☐ 100—Industrial Truck Batteries
- ☐ 200—Mine Locomotive Batteries
- ☐ 300—Shuttle Car Batteries
- ☐ 400—Aircraft Instruction Manual
- ☐ 700—Diesel Locomotive Batteries
- ☐ 800—Railroad Carlighting and Air-Conditioning Batteries
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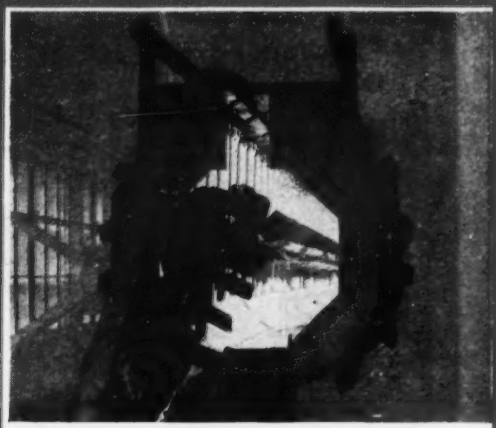
ANOTHER C. M. HALL *PRODUCTIONEERED* RADIAIR OVEN APPLICATION

When This *Infra-Red RADIAIR Oven Went UP Fan Finishing Costs Came DOWN

*Hall RADIAIR OVENS have always incorporated an engineering combination of infra-red radiant energy and the controlled movement of convected heated air. Result: You get the most BTU value for your heating dollar.



$2880 SAVINGS A MONTH IN FLOOR SPACE ALONE MORE THAN PAID ITS WAY

Military jeep, truck and tank production moves along at a fast clip when a contractor like Hayes Industries, Inc., produces 33 vitally needed assemblies every 60 seconds.

Maintaining ahead-of-schedule delivery calls for the finest kind of production planning. When a gas-fired "A" type oven recently loomed up as a potential production bottleneck and fire hazard, Hayes, as might be expected gave infra-red the green light. Because the C. M. Hall RADIAIR oven shown above was designed and applied as a precision production tool—a part of Hayes' in-line production process, maximum time and money saving advantages were realized from the beginning.

The Hayes' oven is typical of many unique applications made by Hall during the last four years. Meeting almost every type of war production heating requirement has brought this necessary process right into the production line . . . has carried the science of infra-red heating to a new high.

If you are concerned with low temperature preheating, dehydrating, drying or baking—keep up to date on Hall's *productioneered* applications of infra-red . . . they will be vital to industry after the war.

Send for "Infra-Red at Work." *It describes the many practical applications of this new production heating process. Learn what infra-red has to offer you. If you want fast action, just ask for a C. M. Hall representative. He'll respond promptly—and competently.*

EVERY MINUTE COUNTS!

IN ONE MINUTE 33 FANS (COUNT 'EM

* * * * * * * * * * *
* * * * * * * * * * *
* * * * * * * * * * *

PASS THROUGH THIS RADIAIR OVEN TO EQUIP MILITARY JEEP, TRUCK AND TANK ENGINES.
That's Production with a capital "P"

PROBLEM: Former fan finishing method meant keeping 1000 gallon tank of inflammable enamel close to gas-fired oven which baked 1000 fans per hour. Problem called for increased production and elimination of fire hazard.

SOLUTION: RADIAIR OVEN was designed as part of in-line production system. Fans now go from degreaser up to ceiling where they are dipped in 400 gallon paint tank and pass through 54 ft. RADIAIR OVEN. Fans then move in cooling cycle direct to boxing department.

ADVANTAGES: Suspending RADIAIR OVEN and dipping tank alone SAVED $2880 A MONTH in vitally needed floor space and eliminated fire hazard. PRODUCTION WAS DOUBLED with capacity to spare. One man instead of three now handles conveyor line. Instant infra-red baking ELIMINATED REJECTS AND REWORK due to paint drip on fan blades. PRODUCTION COSTS CUT 17% or approximately 3c per fan. 'Nuff said—the record speaks for itself and Hall's *productioneered* method of infra-red radiant heating.

C. M. HALL LAMP CO.

C·M·HALL *Lamp Company*

PIONEER DESIGNERS AND BUILDERS OF INFRA-RED RADIANT HEATING EQUIPMENT

1035 EAST HANCOCK ST. **DETROIT 7, MICHIGAN**

The G & W catalog binder is a valuable reference library because the data on equipment is detailed and accurate. It is easy to find what is needed.

Use the G & W catalog when laying out your plans and when ordering devices for your cable installations.

The current G & W catalog includes the following:

BUL. 392— POTHEADS and miscellaneous devices

BUL. DIP— DIRECTIONS for INSTALLING potheads

BUL. 403— CABLE BOXES.

BUL. 425— TYPE "FC" OIL FUSE CUTOUTS

BUL. 543—TYPE "PK" & "PKL" SUBWAY OIL SWITCHES

BUL. 643— AUTOMATIC TRANSFER OIL SWITCHES

BUL. 743— TYPE "RA" SUBWAY OIL DISCONNECTS

DISCOUNT SHEET No. 44.

Let us help keep your G & W catalog up-to-date . . . send us your name for our mailing list. New bulletins and data sheets are sent from time to time to take care of new developments.

We are always glad to supplement the data in our bulletins with further information. You can secure special assemblies of standard parts to take care of unusual installations.

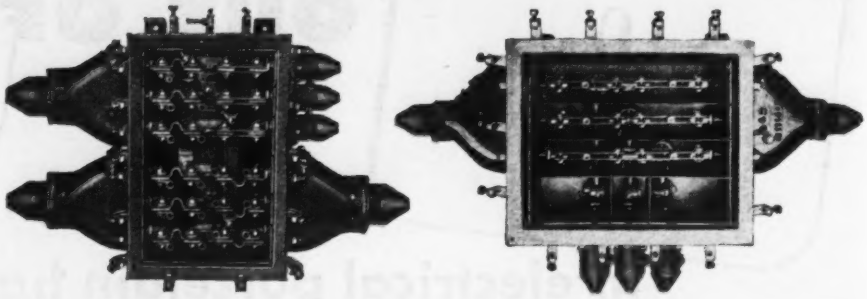
Call in our representative, or write

G&W ELECTRIC SPECIALTY CO.
7780 DANTE AVENUE
CHICAGO 19, ILLINOIS, U. S. A.

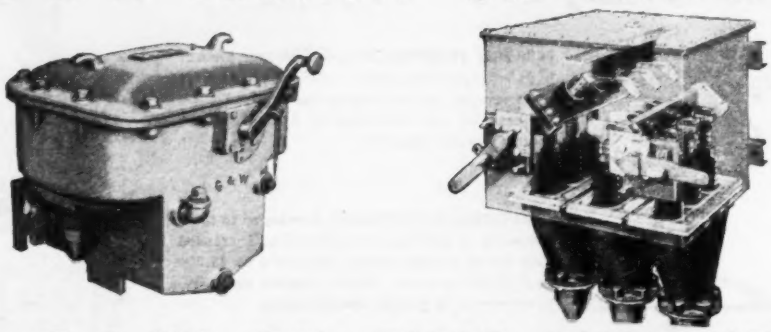
In Canada:
POWERLITE DEVICES, LTD. TORONTO

G & W POTHEADS

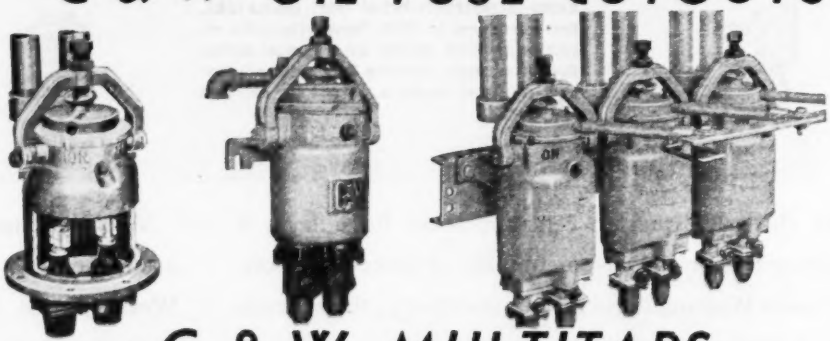
G & W WATERTIGHT BOXES



G & W SUBWAY OIL SWITCHES

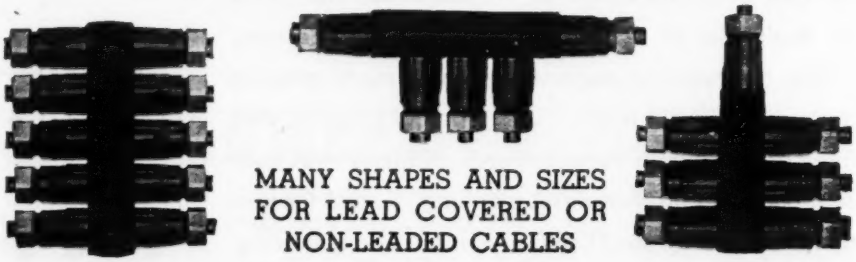


G & W OIL FUSE CUTOUTS



G & W MULTITAPS

TAPELESS, SOLDERLESS SPLICING DEVICE FOR SECONDARY CABLES



MANY SHAPES AND SIZES FOR LEAD COVERED OR NON-LEADED CABLES

5½ OUT OF 8

major design developments in electrical porcelain have been made by Westinghouse

FARADOID PRINCIPLE improved performance of high-voltage transmission lines. Surfaces were proportioned to conform to the equipotential surfaces of the electrostatic field. Now an industry-wide standard.

HIGH-STRENGTH SUSPENSION developed to meet demands of railroad electrification. Increased load limits of suspension insulators to 25,000 and 36,000 pounds. Made possible more improvements in power transmission.

RADIO-INTERFERENCE-PROOF (RIP) INSULATORS, first introduced in 1930. Solved the radio reception problem caused by the usual arcing flow of capacity currents between conductor and insulator surfaces. Now an industry standard.

SOLDER SEALING is to this day the only effective means of producing a hermetic joint between metal and porcelain. Gives permanent protection to oil or air-insulated equipment against moisture or dirt.

BULLET-PROOF INSULATORS increased section thickness, and proportioned surfaces so as to always produce ricochet. Helped solve breakage due to stone throwing and target shooting.

PRESTITE is a revolutionary new porcelain, dense, nonporous with high dielectric and mechanical strength. Can be formed to intricate shapes with close tolerances.

LINE AND STATION POST INSULATORS...a co-development of Westinghouse and other engineers.

In the past quarter century, there have been 8 major porcelain improvements. Six of these have been exclusive Westinghouse developments : : : the seventh was a co-development.

For buyers of porcelain, this is a convincing guarantee that they can count on Westinghouse Insulators for leadership in design, research and manufacture.

The co-ordinated engineering which made possible these advances, is now at work on new projects. Feel free to co-ordinate these research facilities with your own porcelain problems and planning . . . and for porcelain backed by the BEST in *electrical* engineering.

Westinghouse maintains 120 stocking points to assure delivery anywhere in the United States. Westinghouse Electric & Manufacturing Company, P. O. Box 868, Pittsburgh 30, Pa. J-05154

Westinghouse
PLANTS IN 25 CITIES... OFFICES EVERYWHERE

INSULATORS

Good Start for a Power Transformer

Operator at Allis-Chalmers' Pittsburgh plant applying Natvar varnished cambric to form the insulating barrier between core and low voltage winding of a Power Transformer. Multiple strand conductor is used for compactness and for maximum reduction of eddy current losses.

ALLIS-CHALMERS Power Transformers are designed and built for continuity of operation with minimum of maintenance.

In spite of increased industrial loads demanded by the war effort, these transformers have operated far beyond their rated capacity for extended periods without interruption, without other than routine maintenance. *That's performance!*

It is a source of considerable satisfaction to us that Natvar insulating materials, because of their high uniformity, were selected for this important application.

What are *your* requirements? Write, wire or phone us for deliveries — either from the stock of a wholesaler near you — or direct from our own.

Natvar

- Varnished cambric—straight cut and bias
- Varnished cable tape
- Varnished canvas
- Varnished duck
- Varnished cellulose acetate
- Varnished Fiberglas cloth
- Varnished papers
- Varnished tubings and sleevings
- Varnished identification markers
- Lacquered tubings and sleevings
- Extruded Vinylite tubings
- Extruded Vinylite identification markers

THE NATIONAL VARNISHED PRODUCTS Corporation

TELEPHONE RAHWAY 7-2171 • CABLE ADDRESS NATVAR: RAHWAY, N. J.

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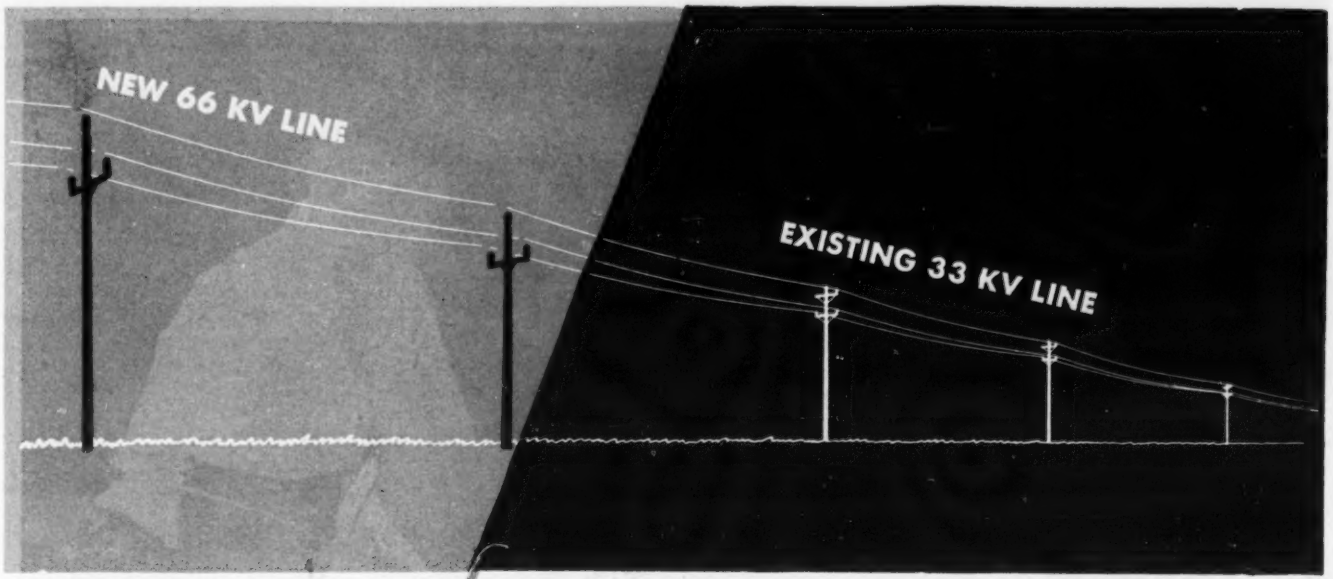


LINE CONVERSION WITH LAPP LINE POSTS

is the fastest way to fortify your system . . . . and uses least materials

New or increased load demands frequently can most efficiently be handled by conversion of existing lines to higher voltage. For this job, Lapp Line Posts are particularly suited. Using present sound poles and conductors, conversion to higher voltages can be accomplished with no more than new cross-arms and Lapp Line Posts. Nor need such construction be considered as an emergency temporary expedient. Such a line approaches the current ideal for a new line; and your Lapp Posts can be expected to give trouble-free service for a longer period of years than you ever got from conventional insulators.

LAPP LINE POST and STATION POSTS on your system offer . .

POWER ARCOVER. *Flashover and leakage distances are not appreciably lowered by damage —even loss of several petticoats.*

NO PUNCTURE. *Puncture path in Lapp Post design is as great as flashover path. Insulator will flash over rather than puncture.*

NO CRACKING. *One piece post body, not subject to bursting from tension strains created by thermal changes in nested parts.*

RADIO INTERFERENCE. *By virtue of design factors alone, radio interference is permanently prevented at rated neutral voltage.*

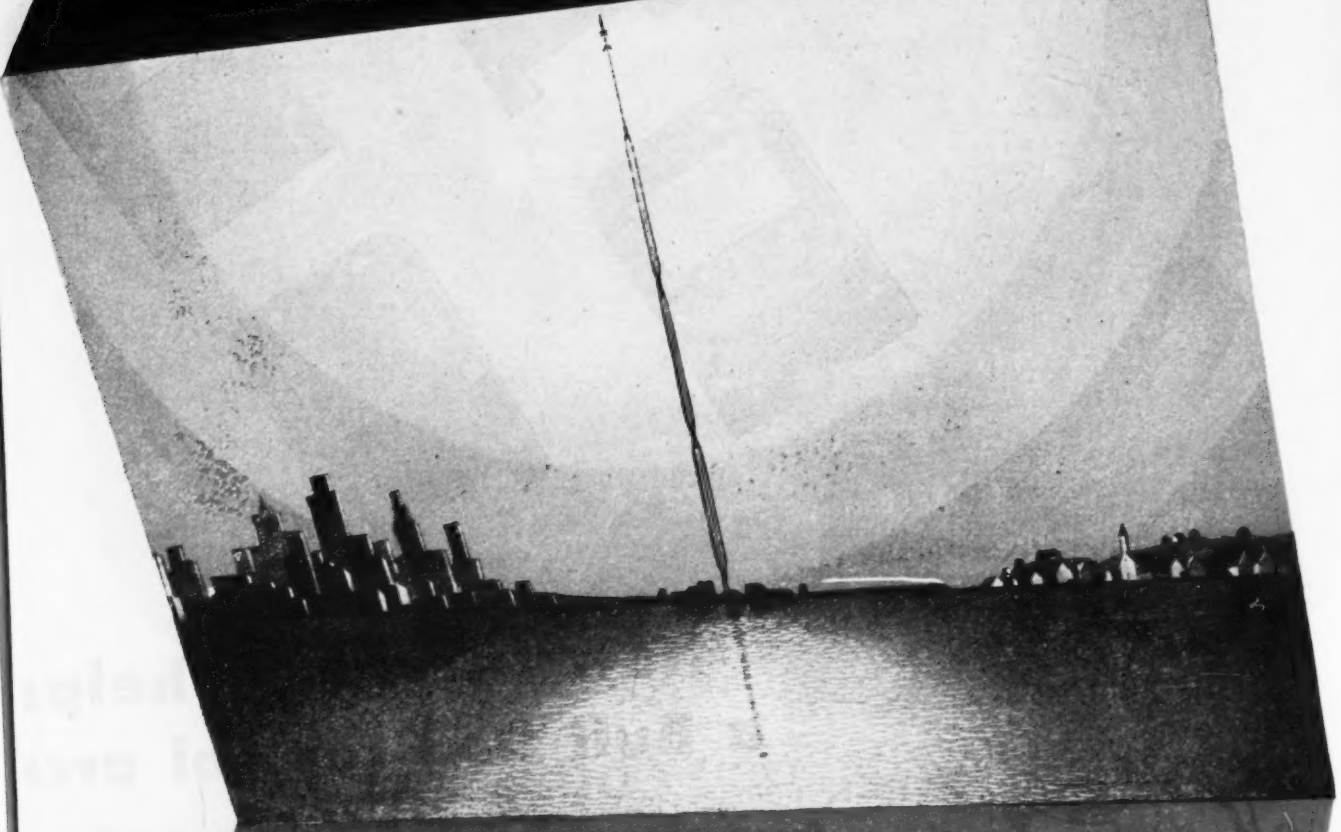
NO CLEANING. *Fog-type design preserves uniform leakage path, prevents leakage flashover, makes the unit "self-cleaning."*

MECHANICAL RUGGEDNESS. *Stones or bullets deflect off, or rupture petticoats, leaving post body intact and insulator secure.*

Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.

LOOKING AHEAD



New ideas and new devices come thick and fast in wartime. America's manufacturers have worked tooth and nail with the Army and Navy to produce all the modern equipment the armed forces need.

Among these manufacturers is Lear. The Lear aircraft radio was well known long before the war. It was ready for the armed forces when war came. Then Lear explored new fields and produced the special Lear midget motors, the Fastop Clutch, and Lear Actuators which make it possible to move airplanes' flaps, shutters and landing gears accurately by electricity.

All Lear wartime developments couldn't be mentioned here. Many of them and the engineering ingenuity which produced them will be turned to peacetime conveniences and pleasures.

For example, there will be the new Lear home radios — instruments built with the integrity demanded by aircraft radio, and equipped with features unknown in such sets before.

So while everything keeps going to get wartimes over with, we can afford a look ahead to the bright spots in the peace we have been fighting for.

RADIO DIVISION, GRAND RAPIDS 2, MICHIGAN
Home Radio Sales: 230 East Ohio St., Chicago 11, Illinois

Lear INCORPORATED

formerly Lear Avia, Inc.

This switch design required not only the characteristics of a laminated plastic, but also the desirability of molding it. Thus, the arc chamber is composed of four units of INSUROK . . . laminated and molded laminated, fibre faced. INSUROK was used because of its constant dielectric and physical characteristics; its resistance to corrosion and ability to withstand continuous hard usage.

How INSUROK helps a Bull Dog control arcs

By keeping the amount of oxygen necessary to support combustion out of the arcing chamber, the Bull Dog Vacu-Break Safety Switch eliminates destructive arcing—secures better rupturing performance, conductivity and safety.

The four INSUROK units in which the contacts "make" and "break" comprise a partitioned arc chamber. Because INSUROK Precision Plastics assure close fitting; because of their high strength and dielectric qualities, they protect and make an important contribution to the efficiency of this Vacu-Break Safety Switch.

INSUROK Precision Plastics are available in a host of grades —in sheets, rods and tubes for fabrication in your own plant, or in completely finished molded or laminated parts or products. Perhaps it can solve one or more of your design problems, as it has thousands of others. For further information, consult Richardson Plasticians—without obligation, of course.

INSUROK

Precision Plastics

The RICHARDSON COMPANY

MELROSE PARK, ILL. NEW BRUNSWICK, N. J. FOUNDED 1868 INDIANAPOLIS 1, IND. LOCKLAND, CINCINNATI 15, OHIO
DETROIT OFFICE: 6-252 G. M. BUILDING, DETROIT 2, MICHIGAN NEW YORK OFFICE: 75 WEST STREET, NEW YORK 6, N. Y.

Will 2,000,000 New Irons Mean 2,000,000 Satisfied Customers?

Yes, indeed, they'll be satisfied—because those irons will give fine service, due to their Nickel-Chromium elements. A lot of them will have Chromel elements. Chromel is the original Nickel-Chromium resistor, you know, and thus set the pattern. It was a happy day, for millions of folk, when Chromel came along, about 37 years ago. You're smart when you specify Chromel, for resistors or heating elements. (There's a lot of useful data in Catalog-M.)

RESISTIVITY @ 68°F

	WIRE (C. M. Ft.)	RIBBON (Sq. M. Ft.)
Chromel-A	650 Ohms	510 Ohms
Chromel-C	675 Ohms	530 Ohms
Chromel-D	600 Ohms	471 Ohms
Copel	294 Ohms	231 Ohms

Chromel
NICKEL CHROMIUM
HOSKINS CHROMEL
ELECTRICAL HEATING ELEMENT
WIRE

HOSKINS MANUFACTURING COMPANY, DETROIT 8, MICHIGAN

1. *A business man asks . . .*

2. *A professional man inquires . . .*

3. *An architect wonders . . .*

4. *A department store manager asks . .*

Does OTIS still make elevators?

Certainly! We've never been *out* of the elevator business, al hough our engineering and manufacturing facilities have been working 100% for the Armed Services.

It is true that we have manufactured vast quantities of parts for guns, ships and aircraft for the Army, Navy and Air Corps but, because vertical transportation is essential in the production and handling of munitions of war and in the operation of aircraft carriers, we have continued to produce a large volume of passenger, freight and special purpose elevators.

We have been too busy producing war goods to say much about the future — but

Now — representatives in our 244 offices are ready and waiting to work with architects, engineers, and owners in the preparation of surveys, plans and estimates on new elevator installations or the modernization, repair or maintenance of existing facilities.

Your action now will expedite future deliveries. Production will begin as soon as material and labor are no longer required for war goods.

Otis ELEVATOR COMPANY
BRANCH OFFICES IN ALL PRINCIPAL CITIES

SEE FOR YOURSELF,

What a Finish

With Aluminum, the manufacturer shapes his reflectors to meet your requirements.

•

Alcoa Alzak-Finished Aluminum reflector sheet being taken from the finishing bath.

*Alcoa Alzak**-*Finished Aluminum is now available for light reflectors*

Lighting gets off to a handsome start when it's backed by reflectors made of Alcoa's Alzak Aluminum lighting sheet. Look at the gleaming surface of this sheet as it comes from the finishing bath.

Alzak-Finished Aluminum reflectors retain their high reflectivity year after year to a remarkable degree. There's no chipping, because the smooth, glasslike, hard oxide coating is an integral part of the metal. They are easy to keep clean and working at high efficiency.

Alcoa does not make reflectors, but supplies top-quality Alzak-Finished Aluminum sheet to reflector manufacturers. Through them you can obtain reflectors for any purpose; with diffuse or specular surfaces, or combinations of the two, for indoor or outdoor work. Whatever your use, be sure to specify the right Alzak finish for each job. ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh 19, Pennsylvania.

*Registered trademark

ALCOA FIRST IN **ALUMINUM**

ALCOA ALUMINUM

BELL TELEPHONE LABORATORIES

Exploring and inventing, devising and perfecting for our Armed Forces at war and for continued improvements and economies in your telephone service

RESEARCH, in the Bell Telephone System, has always been an expanding activity, growing with the scientific knowledge of the times and contributing to that knowledge. Upon it have been based important inventions and developments.

The telephone, itself, was invented in the laboratory where Alexander Graham Bell was carrying on researches in speech and hearing and laying the foundation for the electrical transmission of speech. As time went on the telephone research program expanded to cover every science which gives any promise of improved telephony and every engineering art which applies to the development, construction, installation and operation of telephone facilities.

These researches and development studies now cover electrical communication of speech—both by wire and by radio—the transmission of pictures (television)—and many important projects for war.

There Is No End to Progress

Every new research gives rise to new inventions and to new lines for development and design. New inventions indicate new lines for more research. Research and development work, invention and design go hand in hand. In the early years, this work was carried in part by the American Telephone and Telegraph Company and in part by the Western Electric Company, the manufacturing unit of the Bell System.

For many years, however, this work has been assigned to a specialized unit, Bell Telephone Laboratories, Incorporated. Theirs is the responsibility for the technical future of the industry. They carry their developments from the first faint glimmerings which basic researches disclose to the final design of equipment and the preparation of specifications for its manufacture. And after manufacture and installation, they follow their products in operation; and continue development work to devise still more perfect equipment, less expensive, more convenient and of longer useful life.

These policies and procedures of Bell Telephone Laboratories are distinguished by two characteristics. In the first place the Laboratories design for service. The consideration is not the profit of a manufacturer through first sales and replacement models but the production of equipment which will give the best service at the lowest annual cost when all factors are considered, such as first cost, maintenance, operation, and obsolescence. The Laboratories make no profit and the equipment they design is owned and used by the telephone companies; and the emphasis is upon that use.

Organized Co-ordinated Research

In the second place the Laboratories design always with reference to the complete communication system in which the particular equipment is to play a part.

Reliable, economical telephone service, which is the product of its efforts, is not so much an assemblage of excellent apparatus as it is an excellent assembly of co-ordinated equipment—all designed to work together reliably and economically for a larger purpose.

It is not enough that Bell Laboratories shall design a new piece of electronic equipment which has merit or a new cable or telephone receiver. They must design with reference to all the other parts of the communication system so that the co-ordinated whole will give the best possible service.

4600 People in Bell Laboratories

Bell Laboratories contributions to the Armed Forces derived in large part from the technical background that the Laboratories had acquired through their steadily maintained program of research. The Laboratories had special knowledge, skill and techniques which could instantly be diverted to war problems.

At the time of Pearl Harbor, over a quarter of the 4600 people in the Laboratories had twenty or more years of service. This breadth of background made possible many engineering developments outside the strict field of communication and these have been of value to the Armed Forces. So far the Armed Forces and the O.S.R.D. have engaged the Laboratories on over a thousand major projects. The majority of these assignments have been completed; and have contributed to our victories on many fronts.

Most of the Laboratories developments, of course, have been in the field of electrical communication. Communication, not simply between individuals as in ordinary telephony, but between mechanisms—as in the electrical gun director. The Laboratories techniques and electronic researches have produced many secret weapons for our country's Armed Forces.

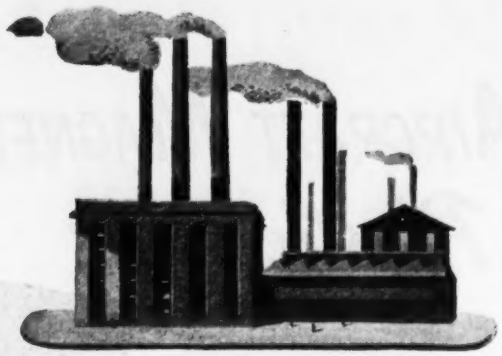
Leader in Electronic Development

For those problems the Laboratories had a remarkable background of experiences in research and development. In World War I, they pioneered by developing radio telephone systems for talking between planes and between planes and ground stations. They also contributed methods and devices for locating enemy planes, submarines, and artillery.

In this war, Bell Laboratories have pioneered in the field of electronics. The Western Electric Company, which manufactures the designs of the Laboratories, is the largest producer of electronic and other war communication equipment in the United States and is now engaged almost exclusively in the manufacture of this equipment.

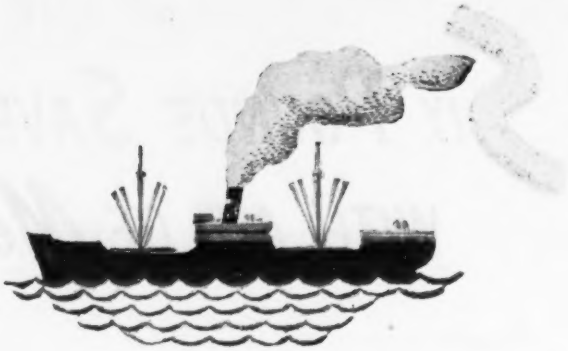
In war, Bell Telephone Laboratories devote their work to the needs of our Armed Forces. In peace, they are constantly exploring and inventing, devising and perfecting for continued improvements and economies in telephone service. Centralized research is one of the reasons this country has always had "the most telephone service and the best at the least cost to the public."

BELL TELEPHONE LABORATORIES



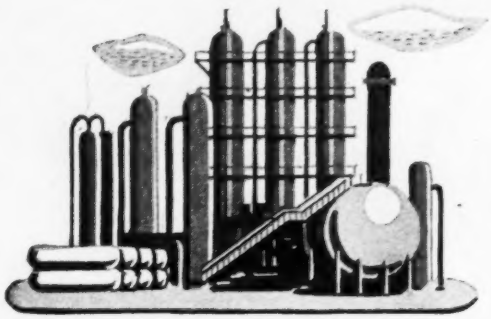
CURED BY A NOSE FOR TROUBLE

Consistent failure . . . at the same definitely-located points . . . led this power plant to apply to Scovill for help. Scovill *Service in Men* helped determine that chlorine leakage was causing the trouble. A few simple installation changes cured the trouble.



DOUBLE RIDE WITH CUPRO-NICKEL

Admiralty tubes operating in 210°F., vapor-side, lasted only 8 months. Contaminated salt to brackish circulating water invited permeable scale formation, favoring dezincification. Scovill *Service in Metals* recommended 70-30 Cupro-Nickel, lengthening service life 100%.



CONCERNING AN INFORMATION EXCHANGER

Many a refinery man, reading Scovill's Condenser Tube Booklet, has widened his knowledge of certain phases of heat exchanger tube service. Scovill *Service in Manuals* reports regularly on studies of Scovill research laboratories plus experiences of Scovill service engineers.

All three types of problems...selection of the proper metal...correct installation practice... desire for further information—are directed to Scovill because it is

One Company Which Gives You

ONE PRODUCT

. . . Condenser Tubes

THREE SERVICES

For a free copy of the new Scovill Condenser Tube Booklet, write SCOVILL MANUFACTURING CO., 24 Mill St., Waterbury 91, Conn.

SIX POUNDS SAVED ON AIRCRAFT MAGNETO WITH AID OF *Melmac* PLASTIC PARTS

Through the use of new materials and new design, the Edison-Splitdorf division of Thomas A. Edison, Inc., found it possible to limit the weight of the new Edison SF9LD-I 9-cylinder aircraft magneto to approximately nine pounds—*more than six pounds lighter* than any other of the same capacity. At the same time, electrical output, mechanical strength, and all-around efficiency were maintained.

Mineral-filled MELMAC*, heat and arc resistant plastic developed by Cyanamid is used for magneto distributor head and two-pole rotor. It proved superior to other materials in hardness, it offered the advantage of light weight and its high dielectric strength and resistance to carbon-tracking add to the life and efficiency of the magneto.

These same physical and electrical properties of MELMAC offer you a wide variety of possibilities for improvement in design and operating efficiency in many types of electrical equipment. Further information on the use of new MELMAC plastics will be sent on request.

*Reg. U. S. Pat. Off.

★

MELMAC *distributor head and rotor operate efficiently under the most severe service conditions in the new Edison SF9LD-I 9-cylinder aircraft magneto, which is installed as standard equipment in Eastern Aircraft's "Wildcat" Fighters, Douglas "Dauntless" Bombers, Curtis Scout and the Grumman and Columbia amphibians.*

Cyanamid Plastics

Beetle · Melmac · Melurac
Laminac · Urac

AMERICAN CYANAMID COMPANY
PLASTICS DIVISION
30 ROCKEFELLER PLAZA · NEW YORK 20, N. Y.

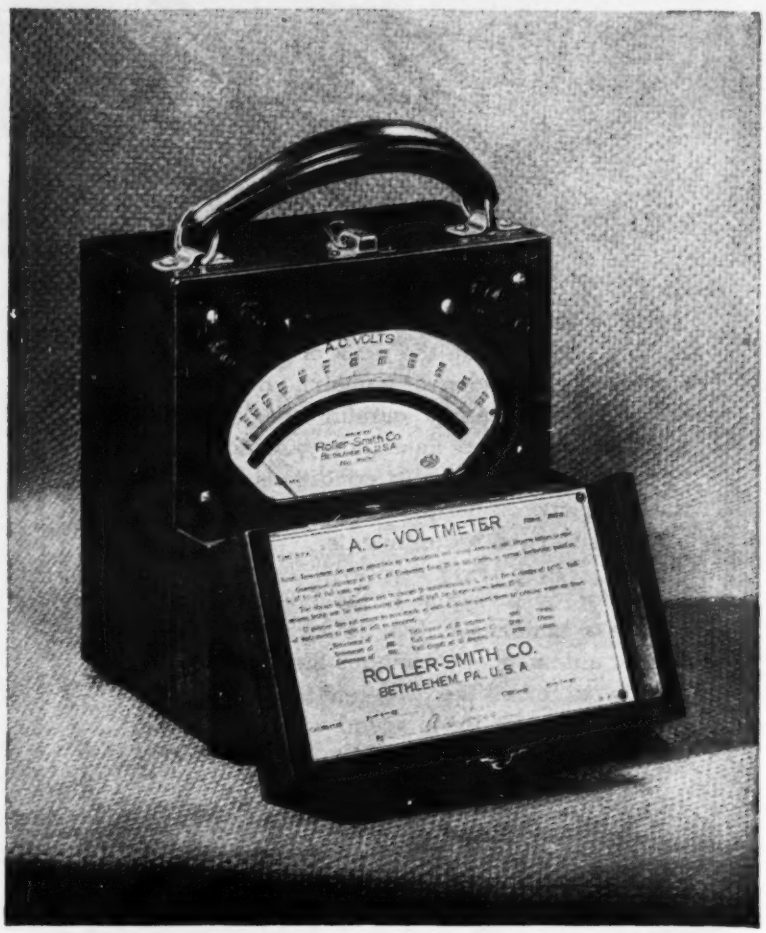
A PORTABLE TESTING INSTRUMENT WITH NO PROJECTING PARTS

ROLLER-SMITH TYPE NP . . .

Roller-Smith Type NP Portable Testing Instruments are designed for general service where a highly accurate and extremely rugged instrument is required. The case is made in two parts: an outer walnut case and an inner two-piece metal case. This construction furnishes full magnetic shielding, protects the mechanism from external strains, and the movement from dust and moisture. The lid of the instrument is designed to completely cover the dial and all binding posts, so that when closed there are no projecting terminals or other parts. The window is of maximum area for high dial visibility; scale length is 5¼". Instruments are 8" square by 5½" in depth and weigh approximately 7 pounds. Ratings cover a broad range of testing requirements.

Roller-Smith Type NP Instruments are supplied in single or multiple ranges for the measurement of direct current in milliamperes, amperes and volts, and alternating current in amperes, volts, watts, power factor and frequency. D-c instrument mechanisms are permanent magnet moving coil (d'Arsonval) type; a-c ammeters utilize a repulsion iron-vane mechanism and all other a-c instruments, an electro-dynamometer mechanism.

Catalog 4340 contains complete description and full information with prices. Write for a copy.



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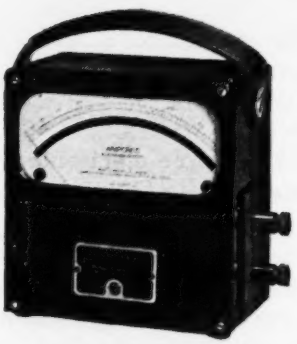

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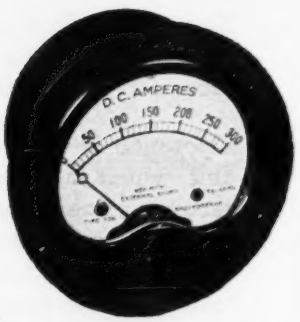

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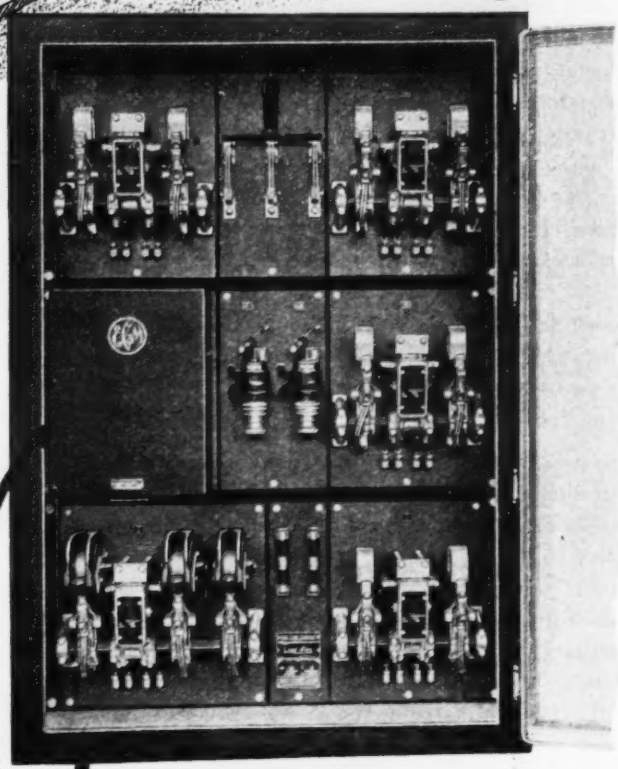

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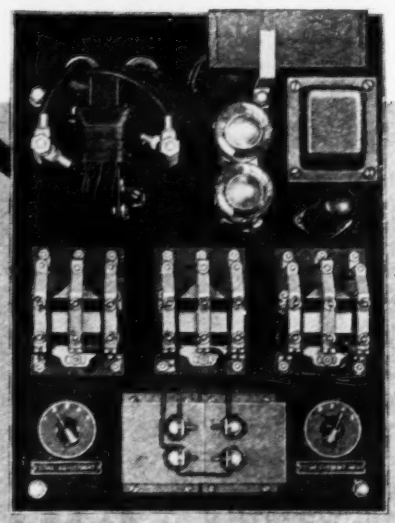

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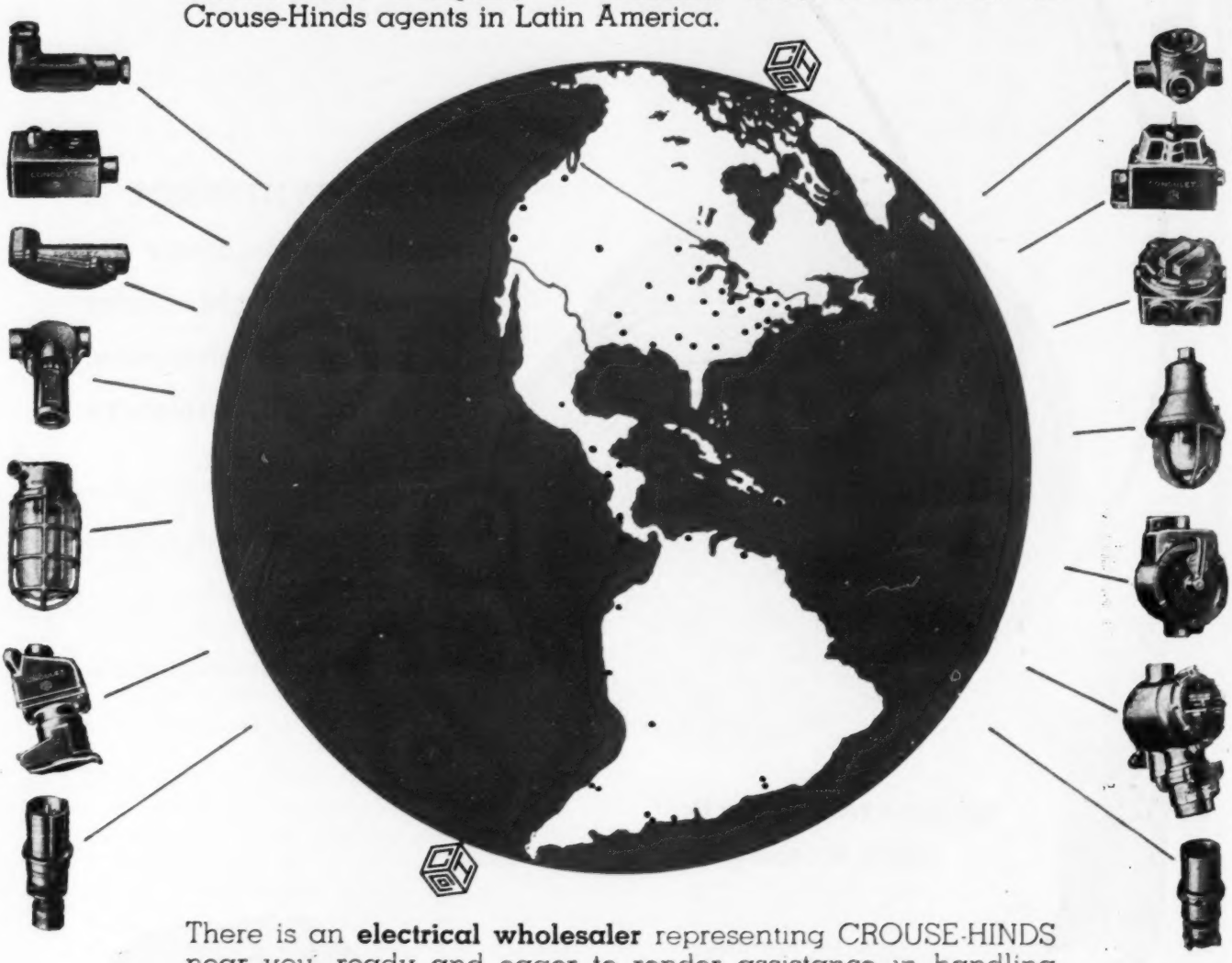

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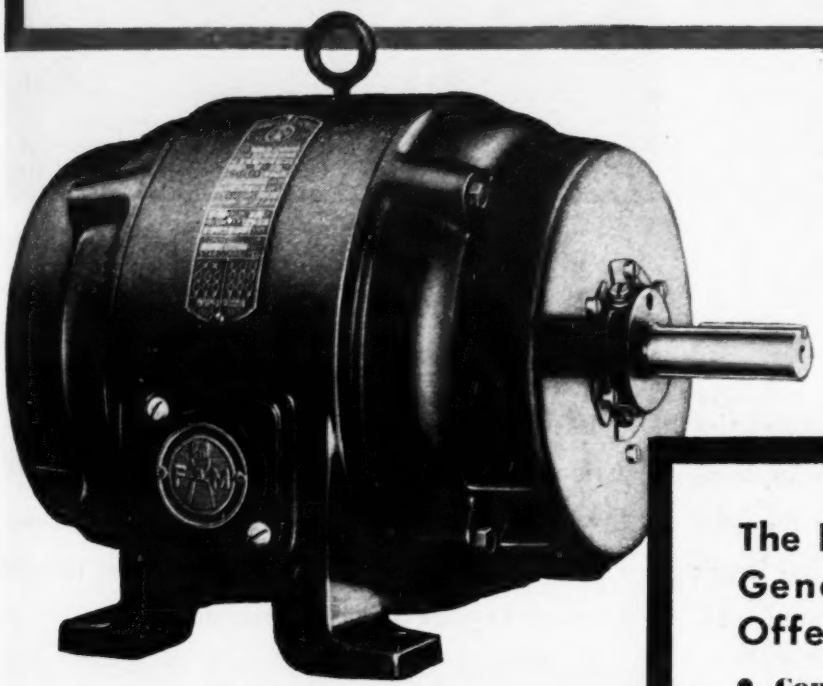

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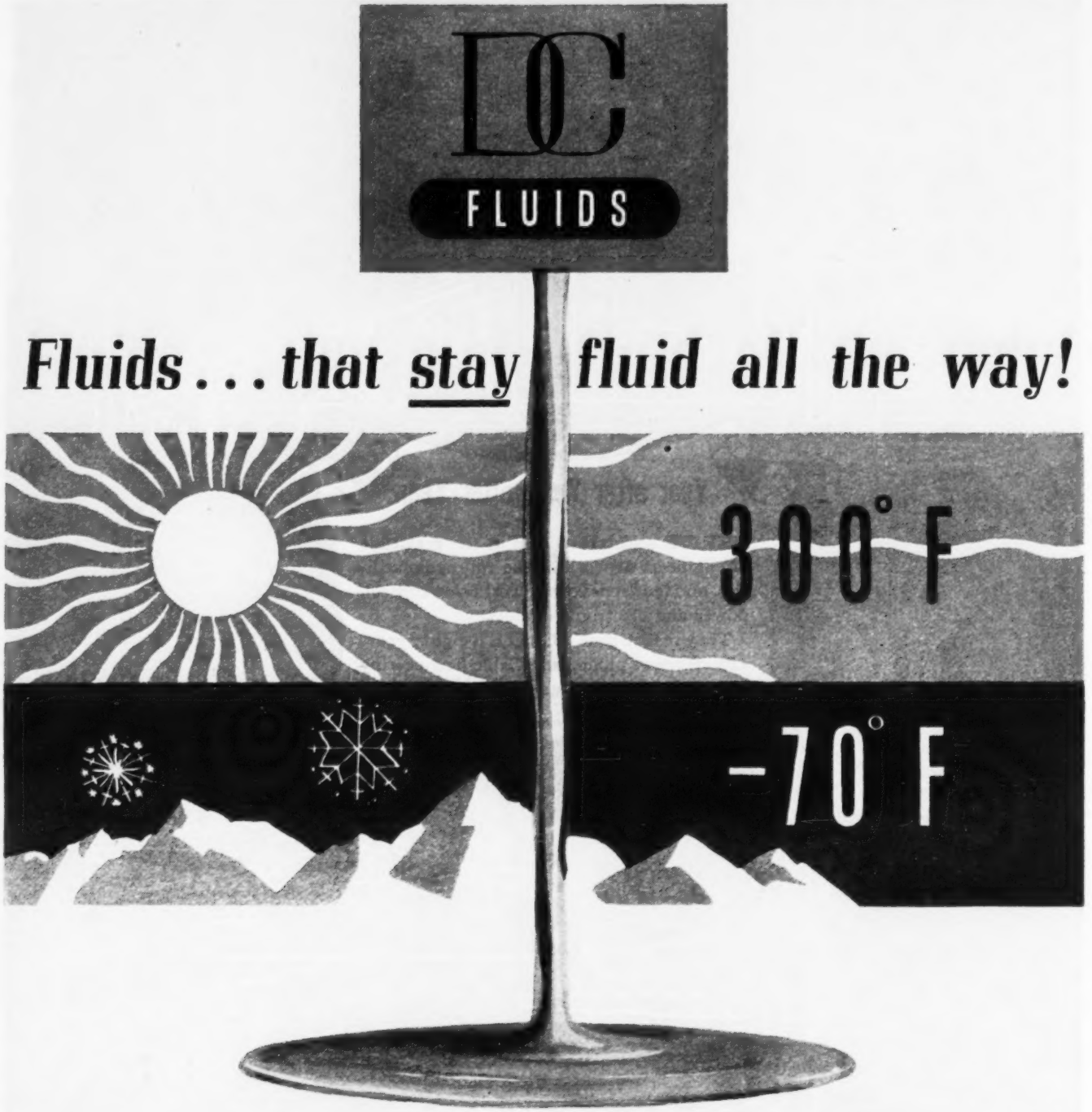

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WHAT DOES AMERICA WANT?

IT IS THE PURPOSE of this editorial, the thirty-first of a series, to state the urgent need for a clear declaration of American policy in world affairs.

Within the past few weeks there has been a wakening conviction in this country that the determination of international arrangements cannot safely be put aside until victory has been won. For we have seen actions taken in Europe seemingly without full consultation and agreement of the Allied powers, which may profoundly affect the design of the post-war world.

A declaration of American policy is needed, and it should be accompanied by a statement of our firm intention to exert full effort to procure its acceptance and furtherance. Emphatically, this does not mean that an American platform should be put forth as an ultimatum, which other nations must accept totally, or reject at the cost of having the United States withdraw from collaborative participation in world agreements and organization. On the contrary, the first plank in such an American platform should be a firm commitment on our part to participate with our associate nations in building a general system of world security and order. By definition, this requires that each participant be willing to accommodate its purely national interests to a program that can be accepted as fairly representing the interests of all. But equally, there is imposed on each participant an obligation to state honestly and openly what it conceives its individual interest to be, as well as its concept of what measures will best serve the general interest.

☆ ☆ ☆

Americans have displayed a singular diffidence in the matter of formulating a bill of American objectives—singular, in that it contrasts so sharply with our power to exercise as broad a leadership as we are able to define. This reluctance stems partly from the inherent difficulty of arriving at a coherent statement of national aims in a country like the United States—so vast in area, so multiple in its sectional and group interests, and so soundly committed to the free expression of individual thought. But it stems also, in part, from a tradition of national isolation which, however understandable in historic perspective, now stands clearly discredited by two world wars which were not of our making, but from which we were unable to hold aloof.

That the economic wellbeing and political security of the rest of the world is closely bound to the decision and performance of the United States is questioned nowhere but in America. Political boundaries and restrictions cannot build effective fences against the interplay of economic forces, and the sheer weight of American economic influence is of crucial import to all the other nations of this globe. In large measure their decisions will be shaped either in response to the opportunities that our procedures offer them, or in defense of interests that our procedures may jeopardize.

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The United States contains only about 6 percent of the world's population. But—our national income, before the war, amounted to almost 25 percent of world income; our industrial output as a whole approximates 45 percent of world totals, and we now are producing a like percentage of the world's munitions; we have 35 percent of the world's railroad mileage; 25 percent of merchant fleet tonnage; 50 percent of the world's telephones; 45 percent of steel production; 40 percent of aluminum production; 33 percent of coal output; we are refining (though part of the production comes from imports) 55 percent of the world's copper, and 70 percent of its petroleum; we now are producing 50 percent of the world's rubber (though post-war resumption of natural rubber production will sharply reduce this balance); our shares of agricultural production are, of course, much smaller, but just before the war we accounted for 35 percent of world cotton production, 15 percent of wheat, and 10 percent of wool.

Whether we like it or not, we must exercise political responsibilities commensurate with the weight of our economic power in an inter-dependent world. But before responsibilities can be assumed, they must be defined. Can the United States arrive at a clear agreement and statement of aims for which it is willing to stand sponsor?

The recent campaigns of both political parties have helped to provide an encouraging answer. In general, election mandates are glaringly deficient as indicators of a unified national purpose. A majority of voters declare themselves for the winning candidate. But even among the majority there are varying degrees of enthusiasm for the platform principles espoused by their candidate; and the substantial minorities of the defeated parties may have had no enthusiasm whatsoever for particular planks in the winning platform, or for the platform in its entirety. A sportsmanlike deference to the will of the majority is a feeble substitute for unified national conviction.

But this Presidential campaign was noteworthy for certain basic principles upon which both the platforms and the candidates of the major political parties were

united. Surely, upon such areas of agreement there may be said to have been an American mandate; the more so, because upon certain of them, we have evidence that no party or candidate could have declared opposition with any hope of victory. What then were these agreed-upon principles? The following is an attempt at a fair summary:

1. That America, in collaboration with its Allies, is committed to seeing the war through to the unconditional surrender of our declared enemies.

2. That America is committed to a responsible role in a world security system after the war, including a commitment to lend the support of our armed forces to repel aggressions that may violate such security.

3. That America is committed to the post-war goal of substantially maintaining in this country an economy that will provide jobs for those who are able and willing to work.

4. That America is committed to the principle of achieving this goal of sustained, high-level employment of manpower and economic resources under a system primarily activated by competitive enterprise.

These are American mandates. They can be made the nucleus of a coherent national policy, for they define aims upon which the great majority of our people are emphatically agreed. But no one can pretend that in this generalized form they serve as more than directional guides for either internal legislation or international negotiation. This skeleton of aims must be clothed with the living flesh of agreed-upon means. Here we have no national mandates of comparable clarity, but it is patently clear that it is our compelling task to achieve them.

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On our elected representatives in government rests the primary responsibility for formulating the specific programs required to implement national policies. Under our system of government, those representatives need continuous nourishment in the form of mandates as to what the people want. Particularly during a period when so many urgent problems are being thrashed out upon an international basis, this imposes a grave responsibility upon all sectors of our citizens; for it requires them to think in terms of the welfare of our nation as a whole, to focus upon those points which offer possibilities for substantial agreement among Americans, rather than upon matters of individual, group, or sectional advantage.

In earlier editorials I have tried to define a basis for national policy in keeping with that broad purpose. They have dealt with problems that are basic to the healthy functioning of free enterprise under the competitive system, with the mobilization of our resources for war and for reconversion to peace-time production, with labor and management responsibilities and relations, with national debt and taxation, with foreign trade and our economic relationships abroad, with the industrial development of backward areas. Since they have been presented in the McGraw-Hill publications, which reach a group broadly representative of all American industry, they have centered upon problems that have an economic rather than a strictly political import.

Future editorials, to appear during 1945, will deal with comparable subjects selected in recognition of the urgent importance for arriving at concerted definitions of national policy. I am fully aware that no individual or group can speak authoritatively for the American Nation. But I hope that an honest attempt to formulate sound concepts of national interest in crucial economic matters will help to crystallize American policy both by focusing agreement and by eliciting dissent.

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Here there is space only to indicate in broadest outline what I conceive to be desirable foundations for an economic policy for the United States:

1. The attainment of a high and sustained level of business activity and employment in the United States and in the world.

2. Active and expanding markets for world trade based upon fair competition rather than upon bloc agreements, discriminatory preferences, and cartel arrangements.

3. The encouragement of industrial development in nations that have been backward in that respect.

4. A recognition that hospitality to imports, rather than constituting a threat to national standards of living, offers in fact the most potent instrument for international bargaining that any nation can command.

5. A willingness to assume a responsible national role in international arrangements designed to provide such financial stability as may be needed to support mutually advantageous world exchange of goods and services.

We must see to it that the end of military warfare does not merely open the door to an era of economic warfare.

The fact is that America has no choice but to assume leadership in world affairs. For the weight of our influence will be felt by other nations no less whether our attitude be positive or negative. And the cost to us of any international obligation which we might undertake must in all fairness be weighed against the equally real cost to us of dealing with measures that others may take to protect themselves against the results of our non-participation.

We have tended in the past to approach international commitments timidly, fearful that we might be outwitted in a world battle of wits. And in so doing, we have too often ceded to others the initiative of suggestion, leaving to ourselves the thankless task of accepting or rejecting what they demand of us.

Our one bargaining weakness stems from the fact that other nations, by contrast feeble in potential power, know what they want and are able to mobilize all their strength to achieve it.

America can be the most effective nation on earth—if only it knows what it wants.

President McGraw-Hill Publishing Co., Inc.

Electrical World
JANUARY 6, 1945

The Year of Choice

A year of promise? A year of despair? A year of great joy? A year of sorrow? A year of less? A year of more?

All of these are in the picture for the new year. One does not have to be a soothsayer to predict that the next twelve months will probably mean more to us as individuals, as an industry, as a nation and as a world than any previous year within our lifetimes. That it will be a year of victory for the Allied forces we all confidently expect. Certainly our armed forces will do their best to bring peace once more to the earth. Certainly our factories and our workers will do their utmost to supply our fighting men with all and more than they need to conquer our enemies.

Before victory is ours, however, we shall have to devote ourselves entirely to war. Our great plans for reconversion while the battle still raged will have to be filed for future reference, for we have learned finally that we can return to peacetime pursuits only when we have peace.

For this reason we can expect to experience a tightening of material control, postponement of less essential operations, reduced civilian supplies, possibly stricter manpower regulations. The next six months, in fact, may be the most difficult of all in our civilian economy.

At the same time we must expect growing casualty lists—losses probably greater than this country has ever before suffered. Nor is it improbable that our forces may have some setbacks. Hard as all these things will be to take, we must keep the knowledge of certain victory before us and not let despair rob us of our strength to win.

This is the stern side of the new year, but there is another side which we hope will be ours to enjoy before another Christmas rolls around —the freedom from war's restraints, the return of our service men, the reconversion of business to the start of a new era of opportunity.

Will it be an era of freedom and opportunity or will it be the beginning of an age of regimented security? In nation after nation the great despair born in the suffering of war is turning people's minds and hopes to the state and with it the socialization of such industry as directly and immediately affects the public interest. America has not yet suffered as have other nations. Will it continue to cling to the principles of democracy?

Are our service men and our war workers going to return to industries that have goals of accomplishment far beyond those of pre-war years? Will capital have the courage to do the things necessary to bring these goals within reach? Will management and labor recognize their interdependence and earnestly strive to create a condition not only mutually advantageous but also in the public interest? Will industry clean its house of reactionaries and repopulate its executive offices with men who look confidently ahead to the future instead of regretfully back at the past?

Our answers to these questions will make this year a more momentous time in history than will the war victory, for in our decision will lie the economic and social progress of this nation. If we decide rightly we shall demonstrate to the rest of the world that democracy not only is workable but that the people who sell their birthright of freedom for regimented security receive but a pittance compared to those who retain their liberty. May history show that America made a happy choice in 1945!

Large-Scale Frequency Meter Sensitive, Prompt and Accurate

Nearly six-inch pointer travel for 0.1 cycle makes for visibility all over operating room—Frequency-bridge principle, motor-operated movement—Calibrated by Lissajous' figures on oscilloscope against broadcast frequencies—Apparatus small and not expensive

J. E. ALLEN, Chief of Tests, Pennsylvania Water & Power Co., Baltimore, Md.

A LARGE OPEN-SCALE 60-cycle frequency meter has been installed in the control room at Safe Harbor to guide the operators in frequency regulation and tie line loading. The meter (Fig. 1) has a range of 59.5 to 60.5 cycles and has a uniform scale. The scale is circular with a pointer radius of 12 in. and a sensitivity of 5½ in. for 0.1 cycle making it clearly visible in all parts of the control room. The meter is continuously indicating and has a maximum pointer speed of 0.1 cycles per sec. There is no noticeable hunting or "dead band".

Principle of Operation

A novel feature of the meter is the use of a frequency bridge, comprised of condensers and resistors, in which only one slide wire is required to restore its balance. The meter may be called a continual balance type (null method). When the bridge becomes unbalanced by a frequency change, the resulting output of the bridge is amplified to energize a reversible two-phase motor. This motor actuates a slide wire to rebalance the bridge. The resistance of the slide wire is proportional to frequency, permitting the pointer attached to the slide wire to indicate frequency on a linear scale.

Frequency bridges, in which both magnitude and phase angle are balanced simultaneously with a single slide wire, have been described by G. Sacerdote[1] in 1934, and by B. Hague[2] in 1938. One of Sacerdote's audio frequency bridges (Fig. 2) was adapted for use at 60 cycles in this meter. The resistance designated as P is the one to which the 12-in. pointer is attached.

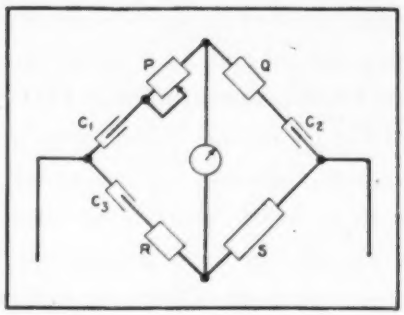


FIG. 2—Meter founded on frequency-bridge principle of Sacerdote

One phase of the reversible motor used (Fig. 3) to actuate the slide wire is energized from the same source as the frequency bridge. Frequency changes above or below a given balance result in a phase angle change of 180 deg. in the bridge output. The reversible motor actuating the slide wire is thereby under directional control from phase angle reversal and in this manner the bridge is continually rebalanced as the frequency changes.

Bridge Components

Input and output filters are employed to insure correct operation on distorted wave shapes. Accurate temperature compensation is provided by having a portion of the P and S resistances made of wire with a positive temperature coefficient. The condensers used are of the precision mica type and the resistors have zero tem-

[1] "Ponti per la misura della frequenza," G. Sacerdote, *Alta Freq.* Vol. 3, pp. 437-443 (1934).

[2] "Alternating Current Bridge Methods," B. Hague, pp. 511-512, (1938 Edition).

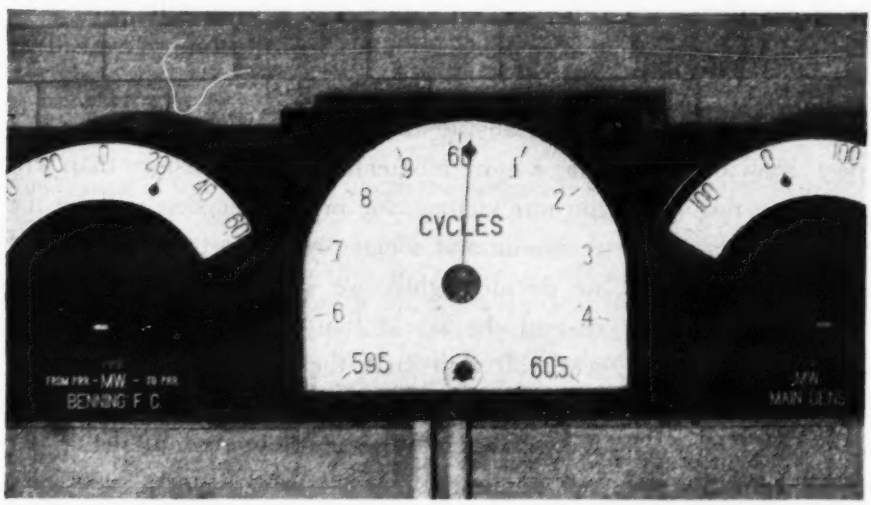


FIG. 1—High-speed indicating frequency meter has 55-in. scale for one-cycle range

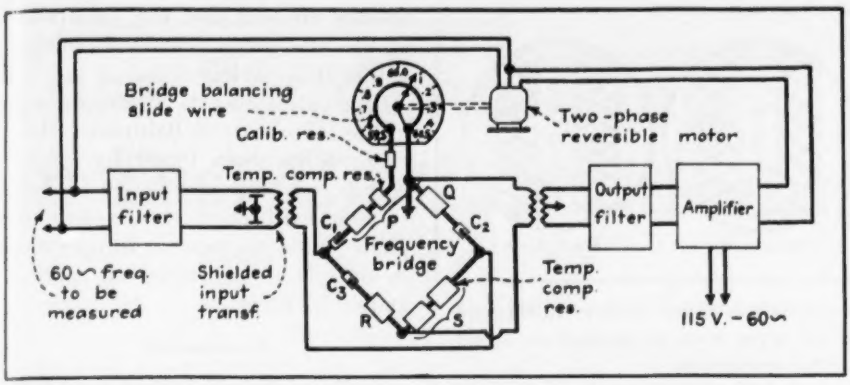


FIG. 3—Schematic diagram of large-scale indicating frequency meter of Fig. 1

perature coefficient. The amplifier, frequency bridge, and filters are shown in Fig. 4.

Calibration

Coincident with the development of the meter, it was necessary to provide facilities for its accurate calibration. For this purpose radio broadcast frequencies were used as a standard. Broadcast stations are required by law to be within 20 cycles of their assigned frequency and therefore they serve as a very satisfactory frequency standard. Actually they are much closer to their assigned frequency than the 20-cycle tolerance, so that even at the lowest frequency the accuracy is better than one part in 30,000.

The new meter was calibrated by the combination of an inexpensive 10-kc. auxiliary oscillator, a radio broadcast receiver, and a 3-in. cathode-ray oscilloscope connected as in Fig. 5. The method is based on the use of stationary Lissajous' figures obtained on the cathode ray oscilloscope when a frequency between 59.5 and 60.5 cycles is compared to 10,000 cycles from the auxiliary oscillator through an appropriate phase splitter. In order to compare frequencies of such a high ratio (approx. 167 to 1) it is necessary to deflect the beam well off scale so that only a few cycles from the 10,000 cycle source appear on the screen.[3] It is necessary to observe only whether or not the figure is stationary to obtain a reading of frequency. However, there will be certain distinctive patterns of stationary figures corresponding to exact cali-

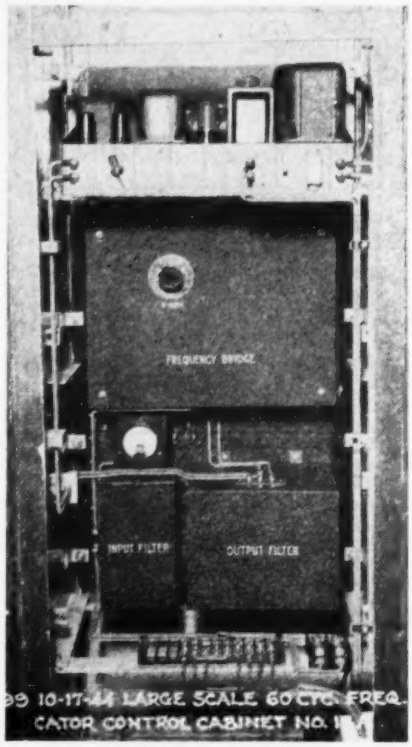


FIG. 4—Control cabinet houses frequency bridge, filters and amplifier

brating frequencies between 59.5 and 60.5 cycles. The patterns may for convenience be called one line, two line, three line[4] etc. as illustrated in Fig. 6. The exact calibrating frequencies utilizing all figures up to and including four lines are shown in Fig. 7.

It is seen that a large number of calibrating points are available including one at exactly 60 cycles.

Identity of Patterns

The identity of the stationary patterns can readily be established by first locating the one-line figures with an auxiliary frequency meter. It will be noted that the one line figures occur at a frequency interval of approximately 0.36 cycles and a precision meter is therefore unnecessary. When the one-line frequency points are established the intermediate points will be obvious.

The 10 kc. oscillator is monitored by beating its harmonics against broadcast station carrier frequencies using both visual and audio zero beat indication. Vernier adjustment of the oscillator is provided in order to permit accurate adjustment to zero beat. It is necessary to check the oscillator against two or more stations; if a nominal zero beat is obtained against several stations with the same setting of the oscillator then there is assurance that the oscillator frequency is 10 kc. and it can be used to check the 60-cycle frequency.

Performance

The meter was given a preliminary check against a source of frequency from a rotary converter controlled by a tuning fork. It was found that the scale was uniform throughout its range, verifying the calculations. Subsequent calibrations were made over a limited scale range using the stationary figures encountered during the normal variations of system frequency. The above method of calibration using Lissajous' figures permits checking and adjusting with an accuracy equal to that with which the meter can be read. Laboratory observations over a period of several

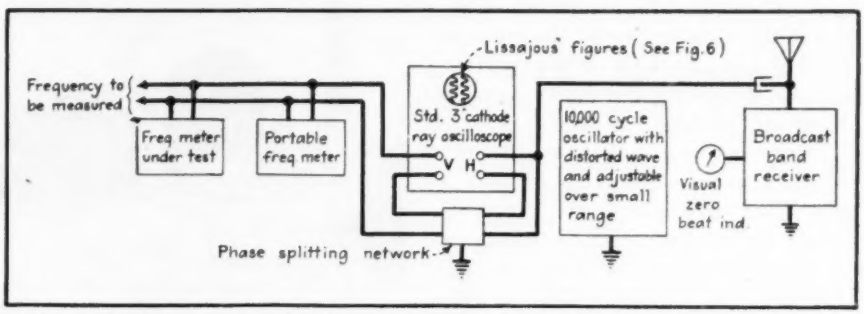

Lissajous' figures (See Fig. 6)
Frequency to be measured
Freq meter under test
Portable freq meter
Std. 3" cathode ray oscilloscope
V
H
10,000 cycle oscillator with distorted wave and adjustable over small range
Visual zero beat ind.
Broadcast band receiver
Phase splitting network

FIG. 5—Method of calibrating frequency meters by Lissajous' figures using broadcast stations as frequency standards

[3] "An Improved Frequency Meter for Commercial Power Frequencies" by K. J. Knudsen, *Electrical Engineering*, Sept. 1941, pp. 866-868.

[4] "The Cathode Ray Oscillograph in Frequency Comparison" by J. K. Clapp, *General Radio Experimenter*, Dec. 1941, pp. 5-8. Reprinted in *Electronics*, April 1942, pp. 94-100.

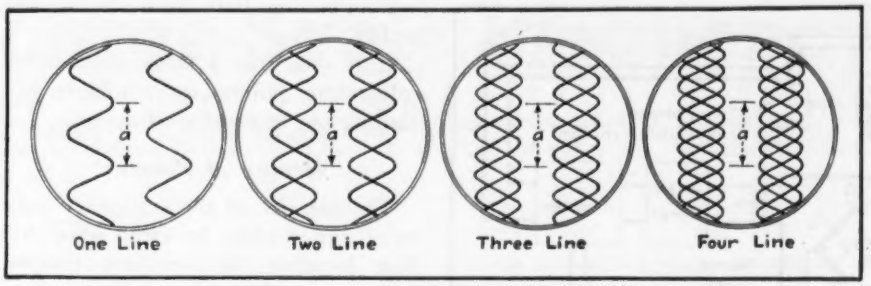


FIG. 6—Stationary Lissajous' figures used in calibration: A one cycle of 10,000-cycle standard. Sine wave shown for clarity; actual wave must be distorted to permit checking by means of harmonics with broadcast frequencies

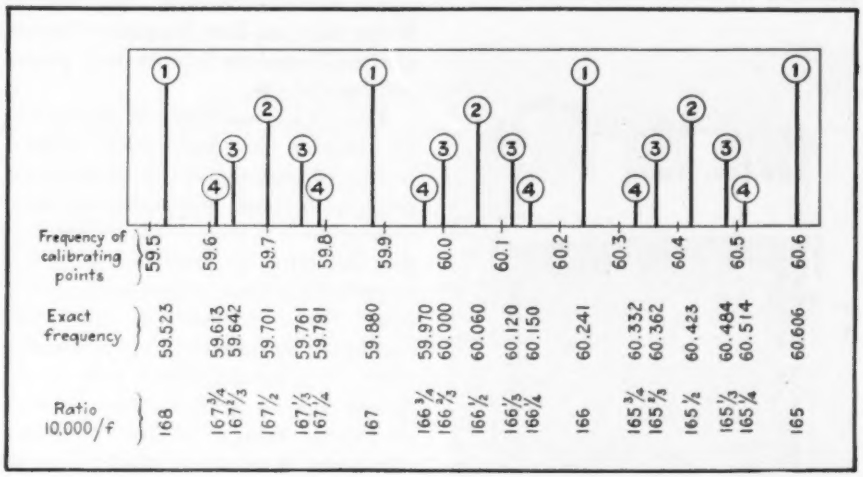


FIG. 7—Number of lines in stationary Lissajous' figures for indicated calibrating frequencies (Standard 10,000 cycles)

months showed that the calibration of the new meter remained constant within 0.01 cycles.

The calibrating facilities are kept in the laboratory at Baltimore. However, it has been found by experience to be quite practicable to make routine calibration checks by telephone while the meter is in operation in the plant, a distance of approximately 50 miles.

Conclusions

1. It is believed that this development represents a forward step in instrumentation by providing station operators with a sensitive, high speed, and accurate frequency meter. It offers a means of measuring frequency in keeping with modern requirements of system operation.

2. Broadcast stations provide a frequency standard of a high degree of accuracy for calibrating sensitive frequency meters. The high power output and multiplicity of such stations insure good reception throughout the country. The use of stationary Lissajous' figures is a fast visual method of measuring frequency accurately. The amount of apparatus required is small and relatively inexpensive.

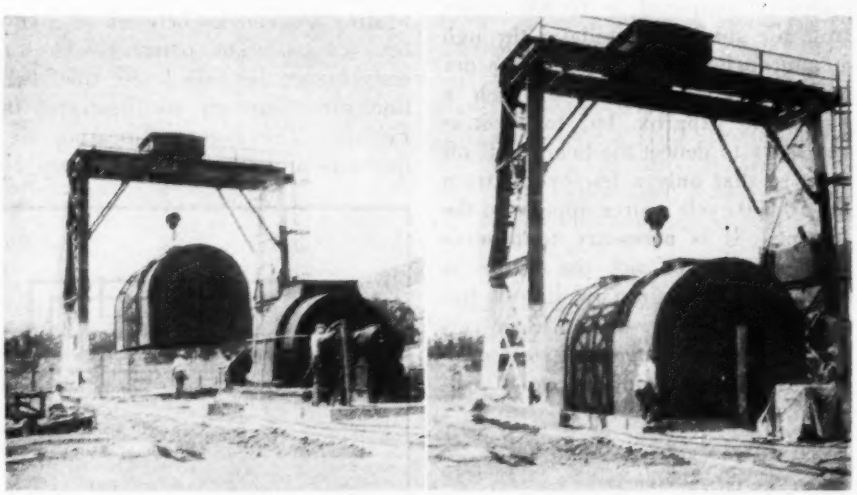
Synchronous Condenser Adapted to Outdoor Use

By E. W. OTTO,
Designing Engineer, San Joaquin Division, Pacific Gas & Electric Co., Fresno, Calif.

The greater part of the cost of a building to house a 10,000-kva. synchronous condenser which was to be moved to a new location was saved by the Pacific Gas & Electric Co. by adapting the machine for outdoor use with a sheet metal housing.

The completed housing, as shown, consists of sixteen-gage sheet iron on an angle iron frame and welded to make it weatherproof. Hatches in the top of the housing permit the crane to be used when working on the bearings without removing the entire housing from the machine.

Air discharge outlet at the top of the machine was closed and a closed air circulating system installed under the machine. Heat is extracted from the air by means of surface type coolers. The cooling water is supplied to these by a closed water system with evaporative type coolers. The housing was made large enough to accommodate the field switches, field rheostat, and condenser accessories. The switchboard is located in the existing substation building in the near vicinity.



COST OF A BUILDING was saved by converting this 10,000-kva. synchronous condenser to outdoor use. Housing accommodates accessories.

Fuse Sectionalizing on Distribution Circuits

Combination of indicating type of 2-shot repeating and 1-shot conventional fuses protects branches, isolates hazardous areas from main feed and sectionalizes individual branch

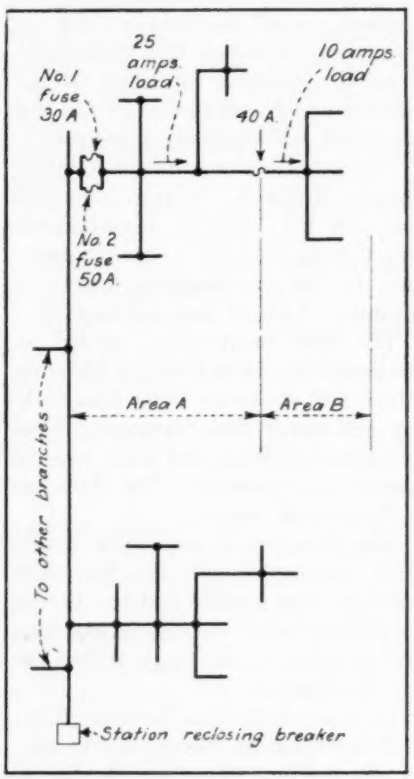
H. E. CARSON, District Engineer, The Narragansett Electric Co., Providence, R. I.

MODERN PRACTICE requires that distribution circuits should be equipped with a quick means of re-energizing in case service is interrupted by a fault on the circuit. In unattended stations this is usually accomplished by means of automatic reclosing breakers and in attended stations by either automatic or manual reclosing. While this feature protects the station from a faulty circuit and restores service after temporary faults, it does not prevent an outage of an entire circuit due to permanent trouble on some remote part of the circuit. As evidenced by the increasing use of sectionalizing fuses, distribution men are concerned with supplementing reclosing breakers with some means of protecting the main circuit from faults on remote parts of the circuit. If the various branches could be economically protected with the reclosing features of the breaker, considerable improvement in service continuity would be realized.

Ample Fuse Protection

Following the above line of reasoning, The Narragansett Electric Co. has devised and has in service several installations utilizing a combination of the indicating type of two-shot repeating fuses and the conventional one-shot fuse. In general this scheme provides ample fuse protection for the branches, effectively isolates hazardous areas from the main feed, and in addition sectionalizes the individual branch. For the lack of a better name, this scheme is called "2 and 1" sectionalizing, and is illustrated in the diagram.

Application of this sectionalizing scheme is primarily for branches feeding from the main or stem circuit. As shown the two-shot fuse cutout is equipped with a 30-amp. fuse in the first position, and a 50-amp. fuse in the second position. The area shown as "B" is in addition protected by a 40-amp. fuse. Should there be a faulty fuse operation, the result can be no worse than if the branch were protected by a single fuse. As far as is practical, the two-shot fuses are installed along main thoroughfares where they are frequently seen by troublemen or line crews. In case the 30-amp. fuse has been blown by a temporary fault, it can be replaced and thereby restore the two-shot protection to the branch.



TYPICAL DISTRIBUTION CIRCUIT equipped with reclosing breaker and "2 and 1" sectionalizing branch

Sequence of Operation

If a fault should occur in area "B", the No. 1 or 30-amp. fuse of the two-fuse cutout will blow, thereby interrupting service to areas "A" and "B". In about two seconds the 50-amp. fuse will come into circuit re-energizing the entire area. If the fault in area "B" is of a temporary nature the entire area will be restored to service; however, if the fault is of a permanent nature the 40-amp. fuse will blow and area "B" will be without service until such time as the fault is cleared and the fuse replaced. Likewise, if a temporary fault should occur in area "A", the 30-amp. fuse will blow and service will be restored when the 50-amp. fuse comes into circuit, but if the fault is of a permanent nature the 50-amp. fuse will blow and both areas "A" and "B" will be out of service.

It will be noted that the current passing through the 30-amp. fuse under normal loading may be higher than is considered good fusing practice, but we believe this condition is permissible in that we have an immediate restoration in case the 30-amp. fuse should blow. Furthermore, the fact that the 30-amp. fuse is carrying much nearer its rated current than is the 40-amp. fuse, the temperature differential is in favor of proper fuse operation. Similarly, if a fault current sufficient to blow the 30-amp. fuse has passed through the 40-amp. fuse, thereby heating the 40-amp. fuse to a high temperature, there is more

assurance of its proper coordination when the cold 50-amp. fuse comes into circuit.

The Narragansett Electric Co. has a number of these installations in service which to date have no record of a false operation. In practice, if a permanent fault has occurred in area "B", it is not always possible to determine if the 30 and 40-amp. fuses blew in proper sequence, or whether they failed at the same time. To obtain better information on this point, a number of laboratory experiments were made to test the coordinating features of fuses, and without an exception the setup worked as planned. During the experiments, five different types of fuses were used and as long as the experiments were confined to fuses of the same manufacturer, the results were perfect. It is obviously out of the question to indiscriminately mix fuses of different characteristics. This mixing was tried experimentally, and it was proved that it will not work except where special consideration is given to the fuse characteristics. The coordination of 30, 40, and 50-amp. fuses might be considered rather close, but we have one installation where 20, 25 and 30-amp. fuses have coordinated quite satisfactorily. It is reasonable to believe that a combination of larger fuses or of two repeating fuse cutouts in series will perform equally satisfactorily, but care should be exercised to be sure that the fuses coordinate with relays of the circuit breakers. We believe that the successful operation is due in a large part to the heating of the fuse elements as described above.

Fuse Deterioration

If a temporary fault has occurred in area "B" and the 40-amp. fuse has been subjected to fault current to blow the 30-amp. fuse, it is reasonable to expect that the 40-amp. fuse may deteriorate to such an extent that a repetition of the fault might cause the 40-amp. fuse to blow ahead of a new 30-amp. fuse. With this thought in mind, a number of tests were run to determine what deterioration could be expected of fuses subjected to repeated overloads. Assuming the fuse is to be blown at 400 percent of its rating, it was preloaded several times to 340 percent of its rating and for a period that would blow the fuse at 400 percent. After each reloading it was allowed to cool to room temperature and finally blown at 400 percent rating. In every case it was found that the deterioration was within the variation found in tests of similar fuses that had not been preloaded. It was concluded that fuse deterioration is not of serious consequence.

A Power Plant in Chungking

By FRED B. BARTON
*War Correspondent in China**

On a September day during my visit to Chungking, I was privileged to visit the power-plant maintained for radio station XGOY, better known as "the Voice of China." The place is under military supervision. They will let you photograph the front of the power house, but will NOT let you show the building in relation to the Chialing River, which flows a hundred feet or so beneath you. Nor is a camera permitted inside.

Think of a heavy stone building, built without doors or windows other than slits, a building with stone walls ten ft. thick. Place on this a 3-ft. concrete slab for a roof. There you have the building built in 1939 to replace a previous power plant hit and partially destroyed by Jap bombs.

The chamber housing the generator reminds you of the inside of the big Pyramid of Cheops. It is 25 ft. high. A small ventilating fan keeps the air circulating when the air is humid and hot, which in Chungking is frequently.

The generator was made in Manchester, England. It turns out 400 hp., 250 kw., 380 v. Transformers step this up to 5,250 v. for transmission to the broadcasting towers, a distance of about four kilometers.

The plant burns coal, carried on the backs of coolies from the Chialing River and unloaded from frail-looking but sturdy little sampans. Coal is scarce in China, and what you see here is very powdery. The plant has a mechanical stoker.

The plant has a water-tube boiler, with pressure of 160 lb. The river water is very muddy and has to rest in settling tanks while soda and lime and aluminum sulphate do their work of clarification.

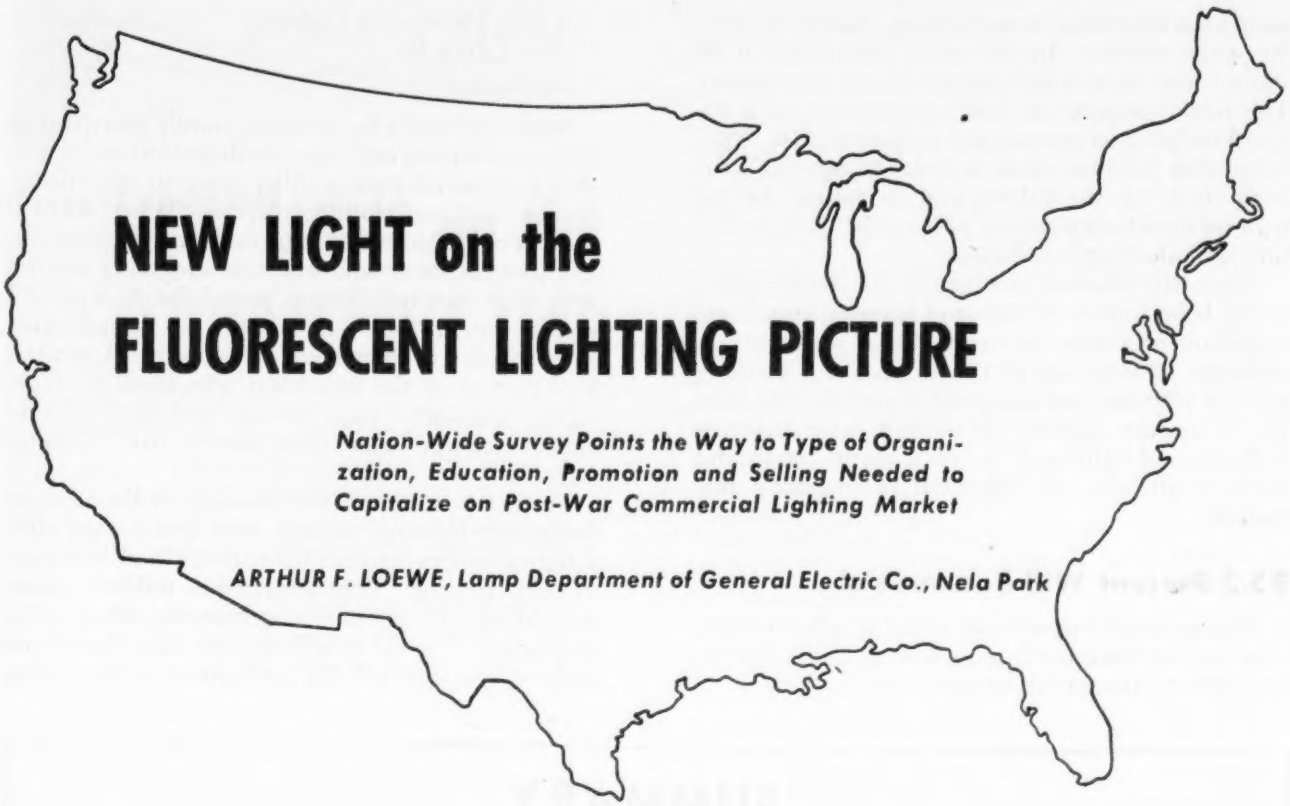
Because both the Yangtze River and the Chialing River, which meet at Chungking, fluctuate 80 to 90 ft. from the low of spring to the high of fall, the job of lifting water to the power-house called for some study. They licked that by running electric wires down to a small boat tethered to the river's edge. An electric pump sucks up the water through a flexible hose and pushes it up the fixed steel pipe to the water-tank above. A watchman on board the sampan guides the intake pipe to clear water and keeps the hose free from brush.

The plant uses 7 tons of coal for 12 hours of broadcasting, from afternoon to midnight. This figures 6 lb. of coal per kw.-hr. Not too bad, not too good, but plenty good considering the aged and frequently repaired equipment they have to use.

Incidentally, the transmission lines are bare of insulation, which calls for clever handling. Station XGOY will be in the market for new equipment of every kind, to be paid for either in Chinese National dollars called "CN" or in American money, called "gold", as soon as the Japs are driven out of China's seaports and entry is once more given to heavy goods imported from America.

Meanwhile, they do the best they can with what they have. Repairmen keep a steady eye on the transmission lines, guarding against any break. Linemen in China, by the way, do not wear spurs. Instead, they use a small trapeze affair consisting of a wooden foot-bar and a stout rope and hook. The lineman reaches up from the ground and slips the iron hook around the pole at chin height, and draws the noose taut. Then he climbs to this level and reaches up with the other rope and hook, giving him a step 20 to 30 in. In this way he clambers up the pole, placing a treadle above him when he wishes to ascend, and reaching down to put a treadle below him when he starts to descend. It is all very simple, but you need a flexible pelvis and a sturdy pair of legs.

* This description was sent to A. F. Davis, Lincoln Electric Co., and by him relayed to ELECTRICAL WORLD.



NEW LIGHT on the FLUORESCENT LIGHTING PICTURE

Nation-Wide Survey Points the Way to Type of Organization, Education, Promotion and Selling Needed to Capitalize on Post-War Commercial Lighting Market

ARTHUR F. LOEWE, Lamp Department of General Electric Co., Nela Park

From surveys and stories in many special publications comes proof that thousands of retailers are eagerly awaiting the day when they can use fluorescent lighting to obtain the last full measure of benefits from this new sales aid. Many of these surveys and most of these stories have been, of necessity, fragmentary, and their value has been largely local. What is the national picture? Are store owners and operators satisfied with the lighting they installed immediately prior to the war? What would they do differently if they were to relight now?

Everyone in the electrical field watched with amazement the phenomenal expansion of fluorescent installations featuring the three and a half short years before the war suddenly halted commercial sales. Starting from scratch in April, 1938, with 200,000 sales the first year that lamps were offered for sale, fluorescent lamp business reached the amazing total of 37,000,000 lamps sold in 1943.

Broad View of Commercial Field Needed

With demand jumping ahead of supply each year, fixture manufacturers could not promptly take care of the business, and the number of manufacturers mushroomed more than five-fold. It is not surprising that the manufacturing set-up was further complicated by the interruption of orderly sales and distribution procedure. Many installations were sold to reduce operating costs rather than to obtain benefits of increased lighting levels, and without adequate engineering or competent lighting advice.

This manufacturing and sales background of fluorescent lighting is well known to electrical men. They do not know yet, however, what effect pre-war sales will have on the future of fluorescent lighting. Contractors, dealers, utility men need more information than that supplied by surveys of limited scope, if they are to make intelligent and detailed plans to serve the rapidly expanding fluorescent market when the removal of war restrictions again opens up the commercial field.

First National Survey Compiled

Obviously, fluorescent lamps, producing from two to three times as much light per watt as incandescent lamps, had wide acceptance in store lighting. Do these merchants with pre-Pearl Harbor installations like it enough to buy more, to recommend it to their neighbors? Where did they go for advice? What do the operators of nearby stores think of typical fluorescent lighting installations? Are they planning to install fluorescent lighting themselves, and from whom would they buy it?

To answer these and many other questions, a nation-wide survey was conducted under the direction of the Lamp Department of the General Electric Co., Nela Park. Extending over a period of almost a year, calls were made by Lamp Department

men in cooperation with lighting specialists from 90 public utilities. In 205 towns and cities in 40 states more than 2,500 retailers were interviewed. The broad purposes of this survey based on a national sampling of opinion and attitude were to determine what has been done in order to forecast what is in store for the future, and to furnish factual material on which plans for post-war lighting promotion and sales might be based.

Those who planned, conducted, and compiled this survey believe that the facts and figures it reveals are significant of a national trend, that it represents an authentic cross-section of the attitude and thinking of those who are now using and those who will later buy fluorescent lighting. As the first national survey of fluorescent lighting in stores, it merits the careful study of all who are interested in supplying this market.

95.3 Percent Will Recommend

After an ample opportunity to test its effectiveness, what did the merchants who have installed fluorescent lighting think of it, how did they like it?

Liking Fluorescent Lighting	88.0%
Not Liking It	9.8%
Undecided	2.2%

Many of those who were not wholly pleased with their installations said that dissatisfaction was due to poor equipment, and, in other cases, to color distortion in food and clothing displays. When asked if they would recommend it to their friends, nonetheless, some of those who were not altogether satisfied with their own installations joined the 88.0 percent who answered "yes." Agreement on the efficiency and economy of fluorescent was general. A total of 97.9 percent of the merchants who installed it got higher intensities than before, and 21.3 percent already realized that they should have installed more.

Further to interpret the thinking of the users of fluorescent lighting, retailers were asked what characteristic of this modern light source held first place in their thinking. They answered as follows: quality of lighting, 28.2 percent; modernization effects, 25.7; cost factor, 23.9; aid to selling, 18.8. That fluorescent lighting as a sales aid did not appear as first in the

SUMMARY

Significant Figures of the Survey Revealed

That . . . 67.5% of merchants decreased their interior lighting load, showing
7.8% decrease in kw.-hr.

And . . . 62.9% of meter readings dropped

While . . . 60.96% of stores put fluorescent in windows with an accompanying decrease in wattage of
44.44%

Yet . . . 55.1% of merchants used lights longer as shown by the records
54.5% of merchants were prompted to purchase by some cost saving

While . . . 97.9% obtained more light than before

Yet . . . 81.2% in interviewers' opinion bought inadequate jobs or were undersold

And . . . 52.8% more kw. could have been sold for interior
53.3% of merchants buying were influenced by neighbors

Only . . . 28.6% of merchants got advice from utility before purchase

While . . . 74.0% of merchants who will buy more, will now seek advice from utility

Finally . . . . . of the merchants now using filament lights
65.9% hope to purchase fluorescent
18.0% are undecided

And . . . 16.1% will not.

thoughts of more seems to indicate, that benefit from better lighting needs the spotlight of promotion turned its way. When asked what general characteristics seemed important, 70.1 percent mentioned modernization; 63.3, sales aid; 62.6, quality; 50.4, cost.

81 Percent Undersold

As is to be expected, a large percentage of fluorescent lighting customers were influenced by the cost factor. Before using it, what advantages of fluorescent lighting prompted the merchant to purchase it?

Some Phase of Cost	54.5%
Quality of Lighting	39.4%
Modernization	21.9%

In the opinion of the interviewers, 81.2 percent of the store operators surveyed were undersold. They had bought installations that were inadequate to their needs. They did not install the lighting that they would have purchased, had they been adequately exposed to the benefits of modern lighting. Before changing over to fluorescent lighting, the average store had 2.69 kw. of incandescent lighting. After the change-over to fluorescent general lighting, the average store had only 2.107 kw. of fluorescent lighting, and 0.315 of incandescent, resulting in a decrease of 9.96 percent of installed general lighting load.

In the answer to the following significant question, there is an indication of a tendency that should be watched. Did store operators changing from incandescent to fluorescent general lighting install the same, more or less kilowatts?

Installed Less	67.5%
Installed More	27.7%
Installed Same	4.8%

Use of kilowatt-hours for all interior lighting showed a decrease of only 7.8 percent in spite of the 9.96 percent decrease in the connected load of general lighting.

Recognizing the deficiencies in their original installations of fluorescent lighting, 21.3 percent of the merchants interviewed said that they were sorry that they had not installed more and 28.1 percent of those who have installed fluorescent lighting want still higher levels of general lighting postwar.

Only 42.2 Percent Used Planned Layout

While the merchants who have installed fluorescent lighting looked before they leaped, less than half of them looked in exactly the right direction. Among the factors influencing their purchases were:

Other Merchants' Lighting	60.5%
Salesmen	46.3%
Printed Material	11.6%

And, although 71.7 percent sought advise before they made a decision, only 28.6 consulted their local utility. However most of these merchants, in fact 77.1 percent of them, knew their utility lighting men. Postwar this condition will change and greater demand will be made on utility lighting men for advice.

A planned layout, certainly indicated in a matter as important as a change from incandescent to fluorescent general lighting, was used by only 42.2 percent. Utility representatives made 60.4 percent of the layouts; fixture salesmen, 21.4; contractors, 15.2; wholesalers, 11.3. Before purchasing more fluorescent lighting equipment, 72.6 percent of the merchants interviewed said that they would seek advice, and 73.9 percent of those said they would consult their local utility. From whom would the merchant ask advice before purchasing more fluorescent equipment? Some will consult more than one source:

Utility	73.9%
Fixture Salesman	12.3%
Contractor	10.2%
Wholesaler	9.6%
Lamp Company	6.9%

Fixture salesmen sold 39.2 percent of this equipment; contractors, 28.9; wholesalers 23.9; utilities, 5.7. When additional lamps and fixtures are again available, 29.6 percent are planning to buy from contractors; 27.8 from wholesalers; 26.3 from fixture salesmen; 8.6 from utilities. Lamps for renewal in these installations were bought 41.3 percent from wholesalers; 29, from retailers; 21.2, contractors; 4.7, utilities.

No changes will be made to add supplementary lighting such as, spot, display, case, niche, mirror, decoration, by 76 percent of the retailers who have already installed fluorescent general lighting, while 19.1 percent will supplement their existing installations. For this purpose, fluorescent lamps will be used by 29.1 percent; filament lamps by 15; 42.7 were undecided.

When the equipment is again freely available, will these merchants change or add to their window lighting? They answered:

Yes	21.0%
No	75.2%
Undecided	3.9%

Among the characteristics of window lighting of greatest interest, window flooding was selected by 79.2 percent, emphasizing display by 20.8. Of those who plan to change their window lighting, 44 percent will install fluorescent lamps, 10.8 filament lamps.

46.2 Percent, Fixture for Fixture

Almost half of the retailers who changed over to fluorescent lamps considered the job completed by simple substitution; 46.2 percent replaced on a fixture for fixture basis; 38.3 installed more; 15.5 installed less fixtures than they had previously. Some fila-

ment lamps were retained by 23.8 percent of those making the change, and the average number per store was 8.8.

What type of fixture was preferred?

Exposed Lamp	84.6%
Suspended Fixtures	77.0%
Continuous Fixtures	5.5%

Installations using four 40-watt lamps per fixture comprised 46.1; those using two 40-watt lamps, 17.9 percent of the total. The average number of lamps used in the general lighting system of each store was 44.9, and 77.9 percent of these were 40 watts. Three great high-traffic groups, apparel, food and drug stores, made up 60 percent of those surveyed. The average store was 61 by 25 ft. and 85.4 percent had a main street location.

Can merchants who have bought fluorescent general lighting be sold more to supplement inadequate installations when additional equipment is again available? This is a question of vital interest to lighting men. It is partially answered by this survey showing that 36.3 percent of those who bought fluorescent lighting had made major lighting changes in the previous five years or less. Of these, 13.3 percent had made major changes in an interval of from one to two years before they installed fluorescent lighting.

More than 1,500 Non-users Surveyed

The fluorescent picture presented up to this point is based on interviews with approximately 1,000 merchants who had installed this light source when it was new. It was made after they had had ample time to form a fair judgment of its value. As noted previously, more than 60 percent of these retailers had been influenced in buying by other installations that they had seen. Would their fluorescent-lighted stores, their reactions and opinions, in turn help to sell others in the neighborhood who failed to change to fluorescent when it was available?

To answer this question, to determine the reactions of merchants not using fluorescent lighting in the neighborhood of the relighted stores, a series of additional inquiries was used, and 1,762 added stores surveyed. These questions were asked in stores in the same neighborhood of those stores which had changed to fluorescent lighting. They were asked of one owner or manager of a store of like character and of the managers or owners of two nearby stores, regardless of type of store.

65.9 Percent of Non-users Will Buy

Of the non-users interviewed, 65.9 percent answered "yes" to the question, "Will you purchase fluorescent lighting when it again becomes available?" Those undecided were 16 percent, and only 18 percent returned a definite "No." While they have unquestionably been influenced by installations that they have seen in the neighborhood, only 26.8 percent will install the same kind, 42.8 are undecided, and 30.4 will not use the same kind. Non-users agreed in general with those who have already installed fluorescent lighting in their stores in that a majority of those whose minds were made up, or 28.4 percent of all interviewed, say they will select an exposed lamp, 14.5 want a shielded lamp, 8.7 express a preference for the "latest type" and 49.5% are undecided as to type of equipment they would purchase.

These post-war prospects for fluorescent relighting seem to have profited by the mistakes of their neighbors with prewar installations, since many said they wanted more fluorescent light than their neighbors originally installed.

Want More	33.5%
Want Same	21.3%
Want Less	9.5%
Undecided	35.6%

The retailers, not now using fluorescent lighting who will seek advice before new installations are made, divide as follows: from their utility, 67.3 percent; contractors, 12.2; wholesalers, 5.9; fixture salesmen, 5.7.

National Averages

It should be borne in mind that the figures here presented result from national averages. Differences that appear significant are measured by the size, and sometimes the location, of the town and city. In the weighing of any individual market these national averages, it should be noted that national figures may not exactly interpret the trends and results in any given community. However, the conclusions that can be drawn from this first national survey of fluorescent lighting in stores can be considered significant because it indicates the present appraisal of fluorescent lighting by typical small merchants.

The interviewers were General Electric lamp men and utility representatives. They selected what they considered as typical small stores that had the greater part of their general lighting in fluorescent lamps, in the cities and towns being surveyed. That these were apparently a representative cross-section of that classification of stores is borne out by the fact that in the tabulation of these figures there was no significant change after the first 50 percent of the reports had been tabulated.

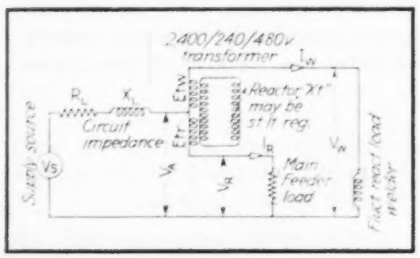
It is clear from the parts of this survey that are considered of sufficient general interest to warrant their inclusion in this summary that the postwar fluorescent lighting job is one that will call for intensive organization, education, promotional and sales effort. This new lighting tool has already done much to revise lighting standards, to elevate general lighting levels. If properly publicized, installed and used, it will make a basic and far-reaching contribution to the adequate lighting of the future.

Voltage Translator Scheme Cuts Light Flicker Due to Welders*

"Voltage translator" scheme offers means of controlling lighting flicker caused by resistance welder operation—Limited to situations permitting some sacrifice in voltage regulation—Principle explained, advantages and limitations discussed

R. O. ASKEY, Senior Engineer, Public Service Co. of Northern Illinois, Chicago, Ill.

CONTROL OF LIGHTING flicker, born of resistance welder operation, has been achieved at the expense of increased voltage regulation to the welder load through a novel "voltage translator" scheme which the authors have applied successfully where lighting and welding loads are served by the same feeder.



VOLTAGE TRANSLATOR interposes an impedance in the supply feeder through a transformer arrangement so that voltage drop through this impedance, caused by either main feeder load or welding load, will appear as a voltage rise on the other load

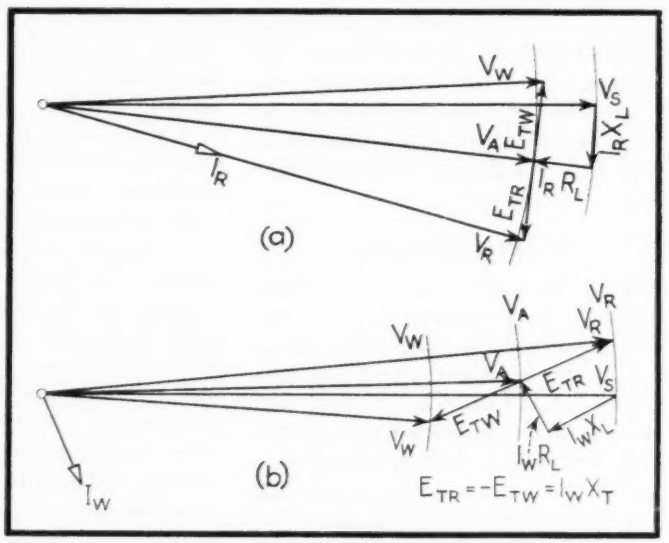
Admittedly limited to situations where particularly good regulation is not required for the welding operation involved, the translator operates on the principle of interposing an impedance in the line through a transformer arrangement such that the voltage drop through the impedance, caused by either the main feeder load or the fluctuating load, will appear as a voltage rise to the other load.

One of the requisites for application of the translator is that it be located on the system so that the fluctuating load may be segregated. Also, the device must be connected ahead of the lighting load. This means that either a parallel circuit must be provided to isolate the two loads or that the fluctuating load is located ahead of the normal feeder load.

The scheme should be particularly applicable where the fluctuating or welding load is located ahead of the normal feeder load and where the fluctuations occur at a comparatively high frequency and produce low-magnitude voltage variations. Under these conditions the additional voltage drop imposed on the welder load probably would not adversely affect welding operations.

Schematic circuit of the voltage translator is shown. In this diagram the line impedance of the circuit ahead of the translator installation is designated as R_L and X_L. The voltage drop resulting from the fluctuating welder current through this impedance is the source of lighting flicker. The voltage which the lighting load would experience without the device is designated as V_A. With the device in service, the voltages across the lighting load and the welder load are V_R and V_W respectively.

Principle of operation of the device is illustrated by the accompanying vector diagrams which, for simplicity, have been made to cover the conditions: (1) With the main residential feeder load only being served and (2) with the fluctuating welder load only being served. It is presumed that the power factor of the main feeder load is 100 percent. A power factor approaching this value is desirable to prevent excessive voltage rise to the welder load resulting from



VECTOR DIAGRAMS illustrate principle of operation of translator. Diagram (a) is for the main residential load only, with the welder not operating. Diagram (b) is for the welder load only. Effect of the residential load is not shown

* Based on conference paper before Electric Welding Session, A.I.E.E., 1944 Summer Technical Meeting, St. Louis, entitled "Welder Power Supply—A problem of Coordination", by R. O. Askey, Senior Engineer and E. R. Hendrickson, Division Operating Superintendent, Public Service Co. of Northern Illinois, Chicago, Ill.

the main feeder load current flowing through the reactor.

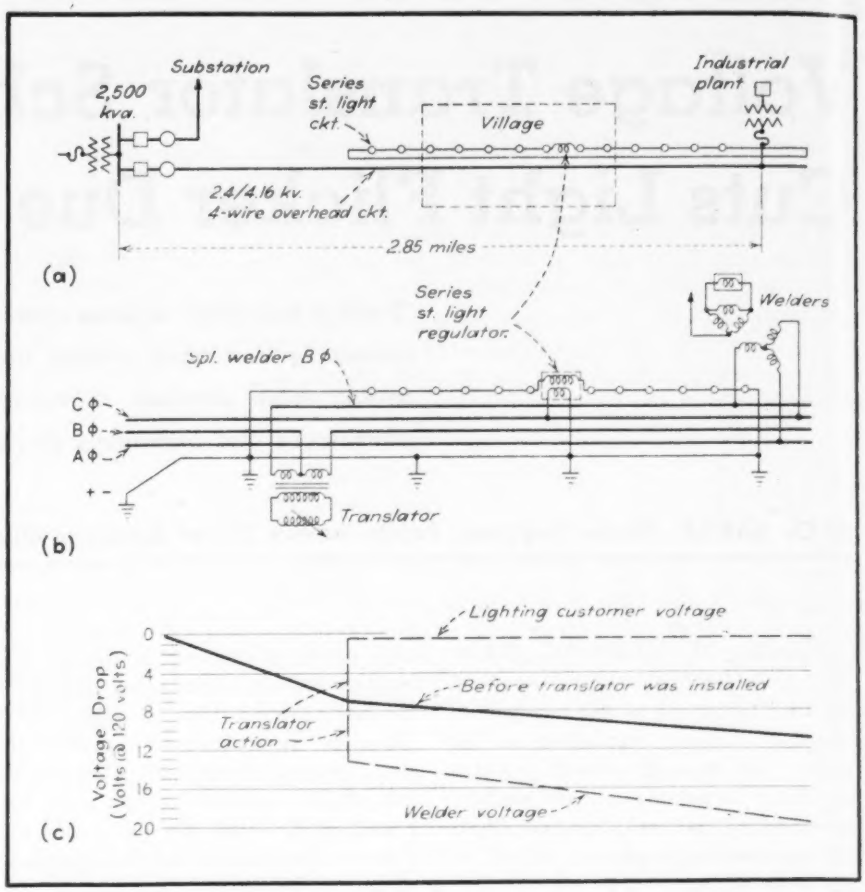
In the diagram applying to the main residential load, voltages E_{TR} and E_{TW} are voltage drop and rise respectively in the translator caused by the unit power factor current of the lighting load flowing through the reactor X_T. These are at right angles to the voltage V_R and accordingly have negligible effect on the voltage V_R and V_W applied to the residential and welder loads. The difference in magnitude between V_S and V_A results from the voltage drop caused by the main feeder load. This voltage drop is compensated for by the main feeder induction voltage regulators which merely increase the magnitude of V_S so that V_R is of the proper value.

Low Power Factor

The diagram for the welder load only, reveals that it is at a comparatively low power factor, which is usual for welder or motor starting currents. Voltage drop across the reactor, designated as E_{TW}, is therefore nearly in phase with the applied voltage V_A. This voltage drop E_{TW} substracts from the voltage V_A which is less than the applied voltage by the impedance drop through the line to the point of installation of the translator. The voltage drop E_{TW} appears as a rise E_{TR} across the main residential feeder load. By proper selection of the magnitude of the reactor X_T, the voltage rise E_{TR} may be made to just equal the impedance drop from the line, such that the voltage V_R across the main feeder load is equal to the voltage V_S at the source. Thus for a fluctuating load, magnitude of the voltage across the lighting load remains the same as the voltage just prior to application of the fluctuating load and accordingly lighting flicker is not experienced.

Practical Application

A specific application of the voltage translator to a practical problem concerns spot welders in a small industrial plant having a 30-minute integrated demand of 65 kw. located 2.85 miles from the substation on a 1,000-kva., 2,400/4,160-volt overhead feeder. The problem was complicated by war restrictions on critical materials. Location of the plant is shown herewith in relation to the supply circuit and a residential village of about 1,500 population comprising the major lighting load on the circuit.



SCHEMATIC DIAGRAMS show application of voltage translator to an actual problem. Initial layout of feeder supplying village and nearby industrial plant is shown in (a). Detailed connections with translator added are given in (b) and flicker voltage gradient—B-phase—is given in (c)

The initial welder installation at the plant consisted of a 50-kva. spot welder which was connected with the understanding that it would be operated at maximum input of 42 kva. A 1.8-volt (120-volt base) fluctuation was calculated to result from this demand. Subsequently the welder demand was increased to 240 kva. or nearly six times the 42-kva. demand that was originally considered the maximum that could be handled without flicker complaints. This 240-kva. demand resulted in a voltage flicker of 9.5 volts (120-volt base) on B phase in the village with fluctuations of 2.3 and 2.6 volts respectively on the other two phases. The 9.5-volt lighting flicker represented an intolerable situation, particularly since the industrial plant was operating two shifts daily with the welders operating during the evening hours.

Solutions Considered

Consideration was given the application of series capacitors in the 2,400/4,160 volt circuit but study indicated this procedure was inadvisable for several reasons:

1. Cost of the series capacitors was disproportionate to the results achieved. Factors influencing cost were special protective devices required, and the fact that at least two installations in cascade would have been required to limit the voltage fluctuations to the lighting customers to within non-perceptible limits.

2. Use of series capacitors would have provided capacity for additional welder load, which if added would have resulted in objectionable voltage flicker appearing on the other feeder supplied by the same substation.

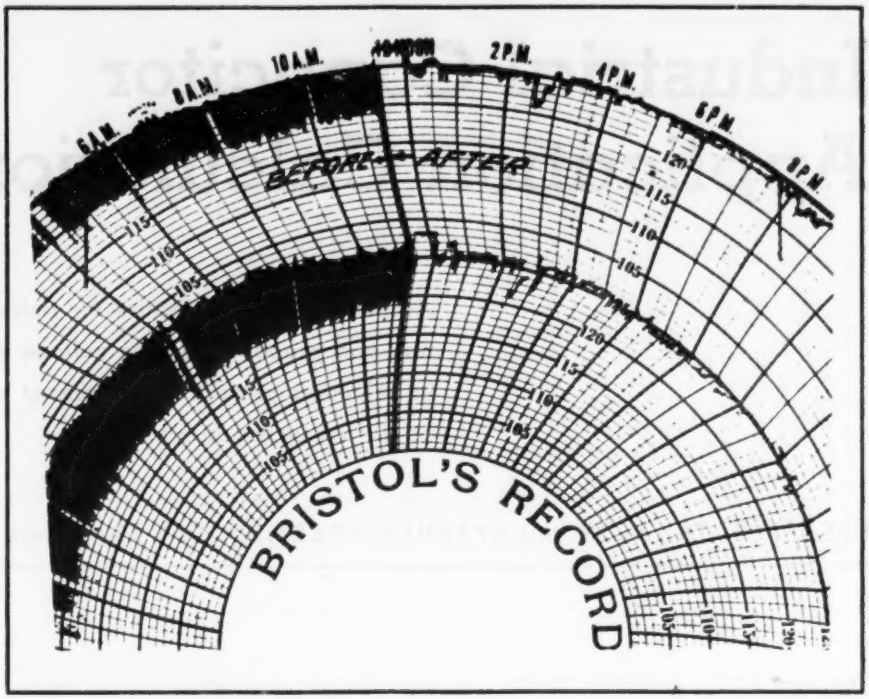
3. Improvement in voltage regulation at the welders was not considered by the customer to warrant the additional expense which would be required for this installation.

Among other alternatives for handling the fluctuating load was that of extending a 33-kv. transmission line to the plant. Obstacles to this pro-

cedure, rendering it impractical, were right-of-way difficulties and the inordinate investment cost of supplying a load of only 65 kw. Moreover, such an extension would have involved large quantities of critical materials.

Installation of a voltage translator just ahead of the village was decided upon as the most practical solution to the welder supply problem. Details of the circuit are shown.

The translator was assembled from a 50-kva. 2,400-240/480-volt transformer and a 15-kva., 6.6-amp. constant-current street lighting regulator, both of which were in stock. The street light regulator was used as the impedance required for the translator. It was selected for this use because, by adjustment of the movable secondary coil, the impedance presented through the translator circuit could be varied within the required limits. The secondary coil was blocked in position at the point where its equivalent impedance, as viewed from the secondary windings of the 50-kva. transformer were equal to the impedance of the 4,160-volt circuit up to the point of the translator installation.



RECORDING VOLTMETER chart taken on B-phase, on day translator was placed in service, shows improvement in lighting voltage

Load Isolated

Application of the voltage translator was contingent upon ability to secure an additional conductor to isolate the industrial plant B-phase load from the balance of the feeder. This conductor was obtained, in place, by a change in practice in the operation of a series street light circuit: two conductors of which were in place on the pole line from the translator installation to the industrial plant. One of these conductors was released for use by using the multi-grounded common-neutral of the feeder as the return for the series of street light circuit. How this was done is indicated in an accompanying illustration. Availability of this conductor, in place, was a major factor influencing the decision to adopt the translator plan.

Measurements of the voltage fluctuations at the business district of the village, made by means of an indicating voltmeter and a specially constructed voltmeter for measuring fluctuations, showed that voltage flicker on "B" phase has been reduced from about 9.5 volts to 0.5 volts. The fluctuations on "A" and "C" phase were unchanged.

A qualitative illustration of the voltage improvement on "B" phase is provided by the recording voltmeter chart, shown. It was taken on the load side of the translator installation on the day the latter was cut in service. Voltage fluctuations before the translator was cut in are considerably less than those actually existing in the business district because of the voltage drop between the voltmeter location and the business district. The voltage after the translator was energized is a true picture of the fluctuations, from the welder, appearing on all "B" phase customers on the load side of the translator.

Experience with the translator, covering somewhat over a year's satisfactory service record, has substantial preliminary considerations leading to its adoption.

Translator Practical Tool

In the light of this experience it is believed that the voltage translator while admittedly quite limited in application is a practical tool for use of the distribution engineer in coping with certain welder supply problems where conditions on the utility system are favorable to its application and where the greater voltage regulation does not seriously impair welding operations.

The welder supply problem vitally affects three parties; the welder user, the welder manufacturer and the utility. Solution of the problem for optimum benefit to all must accordingly recognize the interests of each and be based on the greatest overall economy.

Advance Study

The requisite for attaining this end is a cooperative analysis of the problem prior to welder purchase. This analysis should be based on free interchange of information on utility system capacity and the electrical requirements of welders suitable for the desired welding operations. With this information available, it will be found in many cases that the utility system will be adequate or may be reinforced at nominal expense to handle the high instantaneous demands of the welders without impairing service to other customers. In other cases purchase of welders with special facilities for reducing the high instantaneous demands or making weld quality independent of voltage fluctuations will be found most economical and satisfactory.

It is only through such a cooperative approach that the distressing problems of unsatisfactory welder operation and light flicker complaints arising from installation of welders without due consideration of the supply facilities may be avoided.

Industrial Capacitor Application Calculations—I*

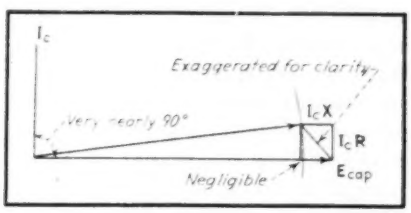
Authors outline procedure for calculating capacitor short circuit current and probable service voltage at capacitor installation necessary in selecting protective equipment and to prevent excessive voltage at the capacitor terminals

JOSEPH S. FRANCIS and STEPHEN FREEMAN, Jr.†, Consumers Power Co., Jackson, Mich.

SUCCESSFUL APPLICATION of shunt capacitors to industrial power systems involves three important but often neglected determinations that should be made for every major installation:

(1) Kind and size of equipment necessary to protect the capacitor as well as other service in case of a short circuit at the capacitor.

(2) Probable service voltage at the capacitor and whether steps should be taken to prevent excessive voltage.



LINE-TO-NEUTRAL voltage rise due to capacitor equals product of capacitor current and circuit reactance

(3) Possibility of harmonic current and what precautions should be taken to protect the installation against them.

To investigate these characteristics of industrial capacitor applications an equivalent circuit may be set up to represent the supply system from generator to capacitor. This equivalent or model system is considered to operate at one voltage. In it each generator, intermediate transformer bank, transmission line, etc., is represented by an impedance which at a given load in volt-amperes will cause the same voltage drop in percent of total available voltage and have the same losses as the original apparatus.

Formulas required for calculating the equivalent reactance for any voltage equivalent circuit, from the nameplate data of alternating current apparatus or from the actual known impedance of line and cables, are given on the accompanying chart. These formulas neglect resistance since all computations are made on the basis of reactance alone. For capacitor calculations this simplification introduces very little error but greatly reduces mechanical work involved.

Equivalent circuit constants for an example problem that will be used in discussions throughout this article are calculated and shown on the accompanying chart.

Now how is this equivalent circuit used to determine the maximum possible short circuit current at the capacitor location and so guide the selection of proper equipment?

What Short Circuit Current?

To disconnect the capacitor in case of short circuit and so protect adjacent loads and equipment in the same plant from possible damage and to protect other customers on the circuit from interruption, the capacitor should be energized through a switch capable of interrupting the maximum short circuit current which may occur at the capacitor location.

To find this current the load end of the series impedance of the equivalent circuit is considered to be grounded by a short circuit placed around the capacitor. The resultant current flow from the power source is calculated. Under these conditions the capacitor switch must be:

1. Capable of interrupting this current.

2. Insulated for the normal circuit voltage at which the capacitor operates.

3. Able to carry, continuously, without excessive heating the rated current of the capacitor.

A maximum practical short circuit current for fuses used in fused safety switches is 15,000 amp. Short circuit currents above 15,000 amp. will require the use of some form of circuit breaker other than fused safety switches for protection against possible short circuit current.

For the example case—

When total reactance (system to capacitor) = 0.0974 ohms

$$I_{sc} = \frac{480}{\sqrt{3} \times 0.0974}$$

or 2,670 amp. at the capacitor terminals while, with total reactance (system to secondary bus) = 0.0305 ohms

EQUIVALENT CIRCUIT calculations for sample capacitor problem →

* This is the first of two articles by the authors dealing with calculations involved in major capacitor installations in industrial plants. Part two dealing with resonance calculations will appear in a future issue.

† Electric Distribution Engineers.

One line	Circuit constants	Apparatus	Equivalent circuit reactance - X Line to neutral values
System	5-KV. unreg. bus	Generator	$\frac{\%\,X_{gen.} \times 10 \times \overline{KV.}^2_{rated}}{KVA_{gen.}} \times \frac{(KV.)^2}{(KV_{op})^2}$ or $X_{gen.} \times \frac{(KV.)^2}{(KV_{op})^2}$
	400,000-KVA. short circuit	System bus	$\frac{\%\,X_{sc} \times 10 \times \overline{KV.}^2}{100{,}000}$ [100,000 KVA. base assumed] or $\frac{1000 \times \overline{KV.}^2}{KVA_{sc}}$
	3%-5KV. 450 A.		
R	260 KVA. 10%-5 KV.		
	5400'-2/0 54" Sp.		
	1800'-4/0 54" Sp.	Reactors	$\frac{\%\,X_{react.} \times 10 \times KV._{rated}}{\sqrt{3}\, I_{react.}} \times \frac{(KV.)^2}{(KV_{op})^2}$
	1300'-4/0 54" Sp.		
	200'-6 54" Sp.		
	3-100 KVA 4800/480 %IX = 1.99	Regulators	For 3φ regulators: $\left(\frac{\%\,X_{reg.} \times 10 \times KV_{rated}}{\sqrt{3} I_{reg.}} \times \frac{(KV.)^2}{(KV_{op})^2}\right)$ For 1φ regulators: $\left(\frac{\%\,X_{reg.} \times 10 \times KV._{rated}}{I_{reg.}} \times \frac{(KV.)^2}{(KV_{op})^2}\right)$
	400'-4/0 34" Sp.	Overhead lines	$X_L \times \frac{(KV.)^2}{(KV_{op})^2}$
	175'-1/0 34" to 7" Sp.	Transformers	$\frac{\%\,X_{trf.} \times 10 \times \overline{KV.}^2_{rated}}{3\phi\ KVA_{trf.}} \times \frac{(KV.)^2}{(KV_{op})^2}$
Load	Proposed 60-KVA. 460 volt capacitors	Capacitors	$\frac{1000 \times \overline{KV.}^2_{rated}}{KVA_{cap}} \times \frac{(KV.)^2}{(KV_{op})^2}$

Explanation of symbols

KV_{rated} = nameplate rated voltage

KV_{op} = nominal system voltage on which equipment is operated

KV. = desired voltage base for calculation

$KVA_{gen.}$ = rated generator output

$\%\,X_{gen.}$ = percent generator reactance

$X_{gen.}$ = rated generator reactance (Subtransient values preferable)

$\%\,X_{sc}$ = system short circuit reactance

KVA_{sc} = system KVA. short circuit

$\%\,X_{react.}$ = per cent reactor reactance

$I_{react.}$ = rated reactor current

$\%\,X_{reg.}$ = percent regulator reactance

Use 1 for 10% regulators
Use 0.25 for 5% regulators

$I_{reg.}$ = rated regulator current

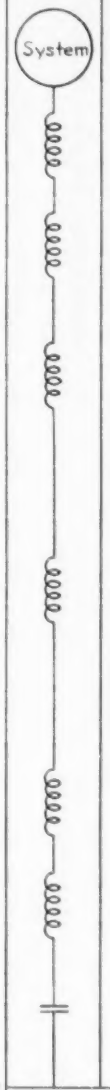
X_L = total line reactance

$3\phi\ KVA._{trf.}$ = rated transformer bank 3φ output

$\%\,X_{trf.}$ = percent transformer reactance

$KVA_{cap.}$ = rated capacitor output

Equiv. circuit



Calculations (Line-to-neutral ohms)

X System = $\frac{1000 \times 5.0^2}{400{,}000} = 0.000576$

X Reactor = $\frac{3 \times 10 \times 5}{\sqrt{3} \times 450} \times \left(\frac{0.48}{4.8}\right)^2 = 0.001924$

X Regulator = $\frac{1 \times 10 \times 5^2}{260 \times 10} \times \left(\frac{0.48}{4.8}\right)^2 = 0.000962$

X Primary = $\left(\frac{5400}{5280} \times 0.714\right)\left(\frac{0.48}{4.8}\right)^2 = 0.007305$

$\left(\frac{1800}{5280} \times 0.686\right)\left(\frac{0.48}{4.8}\right)^2 = 0.002335$

$\left(\frac{1300}{5280} \times 0.728\right)\left(\frac{0.48}{4.8}\right)^2 = 0.001792$

$\left(\frac{200}{5280} \times 0.728\right)\left(\frac{0.48}{4.8}\right)^2 = 0.000310$

X Primary (total) = 0.011742

X Transf. = $\frac{1.99 \times 10 \times 4.8^2}{300} \times \left(\frac{0.48}{4.8}\right)^2 = 0.015280$

X Secondary = $\frac{400}{5280} \times 0.630 = 0.047700$

$= \frac{175}{5280} \times 0.581 = 0.019260$

X Secondary (total) = 0.066960

X Capacitor = $\frac{100 \times 10 \times 0.46^2}{60} = 3.53$

I Cap. = $\frac{480}{\sqrt{3}} \times \frac{1}{3.53} = 78.5$ A

Total reactances - (480-V. base)

System to secondary of transf. bank	= 0.030484 ohms
System to capacitor	= 0.097444 ohms
Transformer and secondary only	= 0.082240 ohms
Primary to capacitor	= 0.093982 ohms

$$I_{sc} = \frac{480}{\sqrt{3} \times 0.0305}$$

or 9,090 amp., if the capacitor was located at the transformer bank secondary terminals.

In the example case, a fused safety switch would be recommended with a continuous current rating of at least 80 amp. at 480 volts in order to safely carry rated capacitor load current.

When one or more locations exist where secondary capacitors may be installed and changes in cable sizes and circuits may be made; also where capacitor locations are subject to later changes, it is wise to provide a circuit breaker or a safety switch capable of interrupting the short circuit current for a fault directly at the transformer secondary terminals. This practice provides safety for the installation and provides for flexibility in use of such switches anywhere on the customer's power secondary bus.

Voltage Determination

Probable operating voltages at the capacitor must be calculated to determine whether excessive voltage is likely to develop and if so, what must be done to reduce it to a satisfactory value. Probable voltage conditions may be easily predicted from calculations on the equivalent circuit, taking into account known operating conditions.

The voltage variation (line-to-neutral) due to the capacitor's being connected to the equivalent circuit is calculated as follows:

From the vector diagram it is seen that for all practical purposes:

$E_{source} = E_{cap} + (I_c R \text{ Cos } 90 \text{ deg.} - I_c X \text{ Sin } 90 \text{ deg.})$

or

$VD = I_c (R \text{ Cos } 90 \text{ deg.} - X \text{ Sin } 90 \text{ deg.})$

$VD = -I_c X$

For line to line values:

$VD = -\sqrt{3}\, I_c X$

or

Voltage Rise $= \sqrt{3}\, I_c X$

In normal operation, the distribution circuit regulator divides the supply system into two portions which must be considered separately:

1. Circuit from source to supply side of distribution regulator.

2. Circuit from output side of distribution regulator to the capacitor.

Voltage changes on the input side of the regulators are usually compensated for by automatic operation of the regulator. However, the voltage output from a distribution circuit voltage regulator can never differ from the unregulated bus voltage by more than a fixed percentage, usually plus or minus 10 percent, dependent upon the regulator rating. Effect of capacitor current in raising the maximum and minimum unregulated bus voltages should be investigated to make sure that the regulator can supply satisfactory voltage to the distribution circuit.

Calculation on the input side of the distribution circuit regulator considers the capacitor connected directly to the substation unregulated bus, supplied from the system source.

Voltage Rise

Voltage rise through the impedance of the equivalent circuit from source to substation unregulated bus, due to capacitor current, represents the voltage by which both maximum and minimum unregulated voltages will be raised. This voltage rise is so small that it may be neglected except where the capacitor represents a major part of the substation capacity, or the substation itself is far out on a long transmission circuit. However, the possibility of voltage trouble should be recognized and a check made whenever the rated current of the proposed capacitors approaches the current rating of the substation transformers.

In the sample problem, a bank of 60-kva. capacitors is proposed. Then the unregulated bus (system) in the example problem will rise

$$\sqrt{3}\left(\frac{60}{\sqrt{3} \times 0.48}\right) \times 0.000576 = 0.072$$

volts (480 volt base). This may be neglected.

Calculations on the load side of the distribution circuit regulator assume constant voltage at the substation end of the circuit. The capacitor is connected at its intended location and the voltage rise calculated, due to the capacitor current alone flowing through the part of the equivalent circuit impedance which represents the distribution circuit:

1. From the output side of the circuit regulator to the step-down transformer bank supplying the capacitor.

For the sample circuit

$$VR = \sqrt{3}\left(\frac{60}{\sqrt{3} \times 0.48}\right) \times 0.0117 =$$

1.47 volts on a 480 volt base. This rise is relatively small and in most cases would be less than the drop introduced by the customer's light load conditions. In cases of doubt, the voltage drop at light load should be calculated and compared to the proposed capacitor voltage rise.

Check on Over-voltage

Because public utility commission rules and design of electrical utilization equipment limits maximum customers' voltage to approximately 125 volts on a 120-volt basis, the voltage rise due to each capacitor installation should be obtained to insure that addition of the capacitor will not cause voltages over approximately 125 volts at other customers' equipment. All customers on a given distribution circuit should be equally treated when requiring that the supply automatic switches to remove capacitors during light load periods in order to prevent over-voltage. A safe rule equally fair to all possible users of industrial capacitors, providing a fair division between customers of the cost of switching equipment, is to require that the voltage rise due to each customer's capacitor installation from substation to customer's bus equal the light load voltage drop without capacitors. As a general rule, each customer should be asked to limit capacity kva. permanently connected to the circuit to value low enough that the customer's own light load demand including capacitors will not cause a voltage rise along the primary distribution circuit,

2. From the primary side of the customer's step-down transformer bank to the capacitor itself.

For the sample circuit

$$VR = \sqrt{3}\left(\frac{60}{\sqrt{3} \times 0.48}\right) \times 0.0822 =$$

10.28 volts on 480 volt base.

I. Hence the voltage on the customers secondary will be increased by 10 volts at both light and full load periods.

Properly designed capacitors are guaranteed to withstand approximately 115 percent of rated normal frequency voltage continuously. Since capacitors are normally rated at multiples of 115 volts, the maximum rated impressed voltages are approximately 132, 264, 529, 2,645, etc. volts.

II. In the sample problem, the present light and full load voltage on the customer's circuits plus the rise in voltage due to the capacitor should be less than 529 volts.

In a sequel to this article the exact amount of capacity which can be connected to the secondary bus is determined.

Rural Phase-Inverters Cut 'Phone Induction

Two 75-kva. transformers balance inductions and reduce effect on the parallel communication circuit exposed to the power lines

LEE M. MOORE,* Rural Electrification Administration, St. Louis, Mo.

A COMBINATION of phase-inverting transformer and resonant shunt installations on a 12,450/7,200-volt rural line of the Black River Electric Cooperative in Missouri served to reduce the induction experienced by open wire communication circuits when a multi-grounded single-phase extension was energized. Railroad signal and communication and Western Union Telegraph circuits are exposed to some 4 miles of 3-phase, 10 miles of V-line and 16 miles of single-phase; separations averaged less than 300 ft. throughout the 60-cycle exposure. The Bell system lines are standard-transposition and some circuits are arranged for C and J carrier operation; the major toll line carries long-distance messages and wide-band programs. It parallels 5 miles in the 3-phase section, 10 miles in the V section and 8 miles in the single phase section; average separation throughout is ⅛ mile; harmonic induction was the primary concern.

* Principal Electrical Engineer, Technical Standards Division

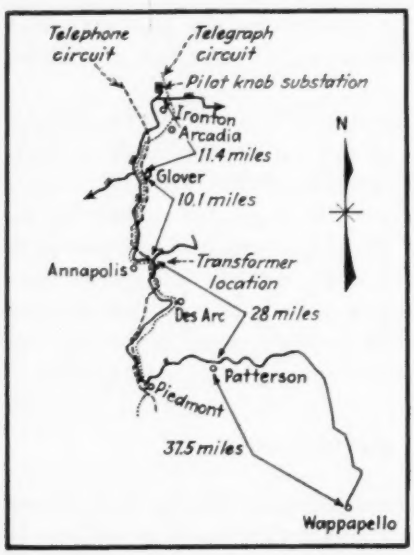


FIG. 1—Exposure map shows rural lines in proximity to signal and communication circuits. Two marks against the power lines indicate single-phase two-wire; three marks, V-phase three-wire; four marks, three-phase four-wire. Feed at Pilot Knob substation is through three 50-kva. transformers, 33-kv. delta to 12.45/7.2 kv. wye with 5 percent impedance. Extension of C-phase from Patterson to Wappapello caused excessive induction to the communication circuits

Resonant Shunts

As a possible remedial measure for correcting the noise induction, 300-cycle resonant shunts were installed on phases "A" and "C" at the Pilot Knob substation. The shunts were effective in reducing the overall TIF from 15 to 6.9, the 300-cycle component from 510 to 162 volts, and the 420-cycle component from 32 to 16 volts. The residual IT of phases "A" and "C" was reduced from 360 to 150, and the overall IT of phase "A" from 360 to 160. The noise-to-ground on exposed telephone lines was reduced from 42 db. to 35.5 db. (message weighting) with the tuned 300-cycle shunts connected during the heavy load period. A 10-db. reduction was obtained when the rural power lines were deenergized. The major reduction in noise-to-ground for both conditions was in the 300-cycle component. The use of 30-kva. capacitors instead of the resonant 300-cycle shunts produced no appreciable change in noise-to-ground on telephone lines.

In order to further reduce the induction on both communication systems, it was decided to transpose the multi-grounded rural power line in the single phase exposure by the use of phase-inverting transformers at a point in the single phase line which would result in a minimum induction to the communication circuits, the principal component of induction being produced by phase "C", thus:

Component due to phase "C" = 25.61 + j0
Component due to phase "B" = −3.01 + j5.21
Component due to phase "A" = −5.06 − j8.75

Resultant† = 17.54 − j3.54 = 17.9 volts

† (Total Induction)

Therefore, if the current in phase "C" could be shifted approximately 180 deg. at a point along the line so selected that the resultant component of voltage due to phase "C" would be equal to 8.07 + j0, then the voltage induced in the communication wires would be a minimum.

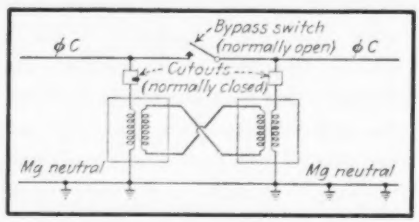


FIG. 2—Permanent installation of two available 75-kva., 7.2/2.3-kv. transformers with 5.5 percent reactance as phase-inverters showed superior results over test installation of two 7.5-kva. 7,200/220-volt transformers with 2.8 percent reactance. Transposing an ungrounded line would have a comparable effect for reduction of noise

Satisfactory Results

Test results with the 75-kva. phase-inverting transformers showed a reduction in noise-to-ground level of 6 to 10 db. (50 percent—67 percent) while the metallic noise level was reduced 3 to 16 db. thus indicating a substantial improvement in noise conditions on the telephone circuits. Measurements of the induced voltages of the telegraph wires between Arcadia and Piedmont indicated reduction in the induced voltages of 75 percent at 60 cycles and 84 percent at 300 cycles. The reduction of induced voltages by the phase-inverting transformers is variable due to the fluctuating loads on the rural power system, but sufficient reduction is obtained to warrant their continued use.

Editorials

S. B. WILLIAMS, *Editor*

A FORECAST

WHAT DO YOU SEE AHEAD for the new year, is a question that is always asked of the industrial and business press around this time and, while we are not seers, our overall perspective does give us the opportunity oftimes to see trends in the beginnings and to indicate possible and probable developments. This year, however, vision is clouded by the fog that has arisen as the result of warm hope striking against cold realism. If we could be sure that Germany would be defeated before the close of the first quarter the predictions for the year could be made with greater certainty of their fulfillment. The prolongation of the war, however, while it might act to alter the accomplishments of the calendar year, will only mean the deferment of putting into effect plans already made. With this prolongation of the war factor ever in mind as a modifier, we offer the following predictions for the year ahead.

Energy Sales

The trend of reduced kilowatt-hour consumption which began several months ago may be expected to continue at least until the fall, although the stepped-up demand for war production should keep any reduction below the previous year to relatively small amounts. It does look, moreover, as though the energy sales for 1944 may be a record that will be a challenge for some time to the sales personnel of the utility industry.

It is likely that wartime will be removed during the year, possibly in the spring, after those concerned with the fuel supply are surer of a continued peak production of coal. However, a return to peacetime would not affect energy production until the fall because of our normal adherence to daylight saving during the summer.

Reduction in energy sales is not expected to have any marked effect upon utility earnings because any reduction in consumption will come in the low-rate business and may be offset by increases in the higher brackets. Moreover, war taxes act to soften the effects of income reductions.

New construction should be large this year. It now looks as though the expenditures will exceed those for any year since the so-called Hoover expansion program to halt the depression, at which time the utility industry overspent even for normal times. The transmission line construction program is really big, challenging in expenditures if not in mileage Slim's march across the country in the '20s. When this program is completed, not too many years hence, this country will have an electric system so integrated as to facilities as to operate on the minimum of reserve, to take full advantage of natures' bounty yet not be alarmed when she frowns, to operate at maximum efficiency and provide the greatest flexibility and continuity of service.

At the same time this year can be expected to usher in the greatest rural electrification expansion we have ever experienced. Both REA and the utilities will strive to see who can do the "mostest fastest." In fact, so keen is the rivalry that it is easily possible that farmers in many instances may have electric service long before they can enjoy it because of a limited supply of appliances. All of this is predicated upon the ability of the construction outfits to get the poles, a small cut of which this winter could curtail construction.

Deferred Maintenance

In spite of statements often made that maintenance was kept up during the war, we look for a very large amount of deferred maintenance to be undertaken this year. In fact, the program for maintenance this year may easily involve an expenditure more than twice that of a normal year.

It would not be altogether right to compare expenditures this year with those of pre-war years because of the reduced purchasing power of the dollar, especially so far as labor costs are concerned. Even so, it is evident that this year will be one of the larger construction years in the industry's history. This does not take into consideration federal financing for new projects, which if started immediately after the fall of Germany would make the year's figures nearer the record.

Rate Reductions

Low money rates have started another flood of re-financing and more can be expected this year with yields so low that one can say almost with certainty that as soon as excess war taxes are removed, and in many cases earlier, another wave of rate reductions will sweep the industry carrying a rate of return that reflects the trend in the price of money.

This year marks the tenth anniversary of the enactment of the holding company bill and should also mark the completion of the major part of the program of distintegration of the holding company systems in spite of the fact that its constitutionality has not yet been ruled on by the Supreme Court although there is the possibility of

decision this year. In its wake more public ownership of local properties can be expected, aided and abetted by present owners when they can get higher prices for their holdings than they could from another utility company.

Utility sales plans are still in the making in many places and for the most part are modest. We suspect, however, that many of these will be stepped up when there are more facts concerning economic trends to guide them. There will be fewer direct merchandising companies than formerly, but a larger number of sales people for customer contacts.

Legislation

Further legislation affecting the utilities especially is not expected beyond extension of the federal power domain. On the other hand, it is possible that local commissions may be more considerate. The feud between them and the Federal Power Commission may have the effect of making the state bodies less inclined to follow FPC lead as willingly as they have in the past.

The returning service men, as well as the employment of disabled veterans is going to be one of the year's problems for the companies that have made no plans but are going to let nature take its course. And with it can be expected to arise a number of other personnel problems. There is an age problem that is really serious that should be tackled during the year.

A reorganization of industry associations, as well as the starting of a Washington bureau of information, is looked for during the year. The Council of Electric Operating Companies finishes in the spring the three-year period for which it was originally financed. Some over all decision accordingly should be expected during the first half of the year.

Promotion Programs

The year will be noteworthy for its cooperative promotional programs. The first national lighting exhibit is scheduled for the spring. Several films will have 1945 previews, starting with the I.E.S. industrial lighting film. Cooperative sales training programs and advertising will spring up. In fact, the war seems to have had a marked effect in bringing home to people of this industry the need for recognizing the extent to which people and business within an industry are interdependent. It is a principle which can be expected to receive more attention during the year, even helping to span the gulf that has existed between labor and management. The year should see greater participation of organized labor in industry programs.

These are but some of the high spots of trends for the new year. It will be an interesting year because of the many and varied problems it will bring, not the least being a release from war restrictions, but these same problems will also make it a year of great responsibility. We hope a year from now we can look back on it and say for the most part that it was a happy year.

Employee Relations Needs Attention

RECENTLY as a part of our regular reader research program we asked subscribers for comments on our editorials and among other things to suggest topics on which they would especially like editorial opinion. The response, in many respects, was an eye opener because of the breadth of area of interest. Because of the size of the survey the response, which was exceptionally good, might be considered as fairly representative of the thinking of engineers and utility management and operating men.

Certain topics, of course, were suggested more often than others, but there was one that should cause management to do a little serious thinking—employee relations. The suggestions on this point didn't all have the same approach, but so many were interested in having comment on employment matters that it is evident that a lot of fellows are doing some thinking on their own part.

One fellow wants us to comment on the fact that "in many electric utilities the so-called white collar worker (including many engineers) often receives less compensation than many of the organized workers."

Another wants us to discuss labor and the "under pay of supervisors."

One wants "more on selling the industry to the public and its employees" and "How about something on employee relations?"

"Discuss the need," says one, "for proper organization in private industry. To have free enterprise it is necessary to fill key positions with capable men who have spent years trying to learn more about their line of work, instead of with men who have spent years trying to learn something about new ways to handle the 'boss'."

One man suggests "that the engineers band together more closely, possibly in the form of a union for more adequate consideration and more pay."

Several were interested in labor union activities and many others were conscious of the lack of adequate industry unity and the effect thereof on the continuance of private operation reflecting ,of course, the possible effect upon their own future employment.

An industry can grow only as it has men and women working for it who have new ideas—people who believe in it and are eager to get ahead. This must be encouraged by management so that people will feel that it is a good place for a career. Today there are many people who have grown old in utility employment who feel that the power business offers opportunity only for the man who is content to get ahead by the seniority route.

Any management that sits back and says "thank heaven that doesn't apply to us," who hasn't found out whether or not it does, is simply courting trouble.

It would be well for management to find out how much it doesn't know about its employees and how they feel and then do something about it in such a way that the employees knew their interests weren't being slighted and that they'd get ahead if they earned a promotion.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

Power Legislation Before New Congress

THE 79TH CONGRESS, which opened last week, will do considerably more of interest to the electric power industry than did its immediate predecessor. This will be true unless the European war continues through out most of the next two years.

The 78th Record

About all the power legislation the 78th Congress passed was the Pace bill, which authorized appropriations for the Rural Electrification Administration for an unlimited period of time, lowered interest rates on REA loans and extended to 35 years the amortization period for these loans; the Flood Control Bill, which authorized but did not appropriate about $1,000,000,000 for flood control works including about 3,500,000 kw. of power capacity; the bill authorizing REA to re-finance rural electrification co-ops originally organized by TVA; the bill authorizing post-war construction of Hungry Horse Dam on the South fork of Montana's Flathead River and three investigatory resolutions, of which only the REA investigation amounted to anything.

Overlooked in the last two years were resolutions calling for investigation of the activities of the Securities and Exchange Commission, including its administration of the Holding Company Act, and two more suspending various SEC activities for the duration; numerous bills and resolutions abolishing wartime; bills establishing the Arkansas-White and South Carolina River Basin programs, the Red River and Savannah Valley authorities, as well as the Missouri Valley Authority and the Rankin Bill authorizing nine regional conservation authorities; a bill establishing a Rural Telephone Administration; another authorizing the St. Lawrence seaway and power project; one re-establishing REA as an independent agency; another re-defining the jurisdiction of the Federal Power Commission to get around the Jersey Central decision; another combining under one head all federal power activities except those of a regulatory nature; another authorizing sale of federal power developments on the Columbia River to the states of Washington and Oregon; the Rivers and Harbors Bill, which was not overlooked but which failed to pass; a bill specifically legalizing acquisition by REA of existing electric systems; a bill adding the Cumberland River to TVA's domain, and various measures aimed at curbing TVA autonomy.

Many of these measures undoubtedly will be re-introduced shortly if they have not already appeared, for some have been before Congress so steadily during the last few years as to have become perennials. At least one of them, the Rivers and Harbors Bill, probably will be passed.

Appropriations After the War

When the war ends Congress will be asked to appropriate the funds authorized in the Flood Control Bill and those which probably will have been authorized by that time in rivers and harbors legislation. In signing the Flood Control Bill recently, Mr. Roosevelt stated that its authorizations are "primarily for post-war construction and until the current wars are terminated, I do not intend to submit estimates of appropriations or approve allocations of funds for any project that does not have an important and direct value to the winning of the war."

An indication not only of the administration's desire that MVA legislation be enacted but also of the difficulties it faces is contained in the President's statement issued when the Flood Control Bill was signed.

"My approval of this bill," the President wrote, "is given with the distinct understanding that it is not to be interpreted as jeopardizing in any way the creation of a Missouri Valley Authority, the establishment of which should receive the early consideration of the next Congress."

After the lengthy debate on various broad policy amendments which the Senate wrote into both the Flood Control and Rivers and Harbors bills, in which MVA proponents sought to bar any language which conceivably might be pointed to in the future as mitigating against an MVA, the President's statement is a blunt re-affirmation of his desire for river development along the lines worked out by TVA. It is also recognition of the opposition to MVA, which has been less publicized in recent months than MVA's support has been, but which is potent nevertheless. Whatever MVA's chances of approval, and sentiment among qualified observers is divided, it is reasonably certain that the bill will not get to the floor for action for some months. It is much more likely that a bill for the establishment of seven or more regional authorities will be defeated if it is brought to the floor.

The St. Lawrence project faces even rockier sledding than MVA legislation for, unless the temper of the Senate changes more drastically than there is reason to expect it will, the St. Lawrence will have to be approved in treaty form, and the proportions of its defeat in the form of an amendment to the Rivers and Harbors Bill —56 to 25—were such as to raise doubt that the bill will muster a two-thirds majority of the Senate.

Interstate Power Regulation

Legislation re-defining the Federal Power Commission's jurisdiction over interstate energy sales will be reintroduced. The measure was introduced last May with bi-partisan House and Senate sponsorship, but was not considered by the Interstate Commerce Committee of either house. The National Association of Railroad and Utilities Commissioners, sponsors of the bill, re-affirmed at Omaha last fall the resolution approved a year earlier at Chicago calling for introduction of the legislation. That the bill will pass is considered doubtful. That the President would sign it is considered more doubtful, and that it could be passed over a veto is thought virtually impossible.

NEWS OF THE WEEK

TVA Gross of $35,429,000 Brings $14,116,000 Profit

Report for Fiscal Year Ended June, 1944, Reveals System Output Went over 10 Billion Kw.-Hr.—Three-Quarters of Generation Went to War Production—Authority Aided War Effort in Many Ways

The Tennessee Valley Authority did a gross power business of $35,429,000 in the fiscal year ended last June 30, with a net profit of $14,116,000, an increase of 8 percent over its fiscal 1943 net, the authority's annual report showed this week. Sales totaled 9,110,370,790 kw.-hr.

Pushing its system output over 10,000,000,000-kw.-hr. for the first time in history, TVA furnished about three-quarters of its generation to war production, according to the report, which showed also that the agency contributed to numerous other war production activities through manufacture of chemicals, fertilizers and maps.

"During the year," the report stated, "TVA completed designs and specifications for 11 powerhouses for the Russian government, an assignment received through lend-lease, and initiated procurement of the materials with which to build them. The designs were made in close collaboration with a commission of Russian engineers."

TVA's electric operations grew substantially in every way except the size of the area, the report showed. During April, May and June, 1944, the system led all others in output.

TVA's 129 municipal and cooperative contributors showed increases in the number of consumers, sales, gross revenues and net income, with average household use increasing to 1,707 kw.-hr. while the average rate for this energy dropped to 1.88 cents. In the year ended last June 30, average domestic consumers in the TVA area used 53 percent more power and paid 19 percent less for it than the average domestic consumer in the nation, according to the report.

TVA deliveries to large industries, most of them in direct war production, rose to 4,900,000,000-kw.-hr. during the fiscal year, an increase of 700,000,000 kw.-hr. Interdepartmental use of power rose 93,000,000 kw.-hr. to 630,000,000 kw.-hr. Municipal and cooperative distributors reported that 3,200 industrial users took 5 percent more energy.

TVA's total generation was 10,117,748,000 kw.-hr., an increase of nearly 12 percent. Purchases from private companies totaled 65,551,000 kw-hr., and receipts under interchange agreements netted 671,318,000 kw.-hr. for a total system input of 10,854,617,000 kw.-hr. Of this input, 9,110,371,000 kw.-hr. went to municipal, cooperative, industrial and other consumers, including sales of 372,350,000 kw.-hr. to private companies which received another 1,015,983,000 kw.-hr. under interchange agreements. System use and line losses accounted for the remaining 728,264,000 kw.-hr.

TVA's hydro output totaled 83.3 percent of system generation and amounted to 8,424,935,000 kw.-hr., an increase of 10.7 percent. This was about double the 1942 output and was achieved through installed hydro capacity totaling 1,500,000 kw. Steam generation, out of 393,000 kw. of capacity, totaled 1,692,813,000 kw.-hr., about 40 percent more than during the previous year. Approximately two-thirds of the steam output was generated at the Watts Bar steam plant.

Coal consumption at five major and several minor steam plants was 969,900 tons, 233,100 tons above 1943 use. Average cost was $3.88 a ton. Average use per kw.-hr. at Watts Bar was 0.91 pounds of coal. Average for all steam plants in the system was 1.25 pounds per kw.-hr.

TVA's transmission system was expanded by 126 miles during the year to bring the total transmission system to 5,857 miles. Additions included a 154-kv. line between the Watts Bar steam and hydro stations and Nashville, the third major tie between eastern and western parts of the system, and a similar line, to be operated initially at 110 kv., between Kentucky Dam and Martin, Tenn. Work was begun on another line between Kentucky Dam and Clarksville.

Average revenue per kw.-hr. for sales of 9,110,370,790 kw.-hr. was 3.86 mills, an increase of .12 mills over the 1943 figure. Kilowatt-hour sales were 9 percent above the preceding year, with revenues 12 percent higher.

4 Percent Return on Investment

Operating income of $14,737,000 for 1944 after provision for all operating expenses, depreciation and payments in lieu of taxes, but before interest, represented a return of slightly more than 4 percent on the average investment in power facilities.

The 1944 fiscal year ended the first five-year period of representative power operations, according to the report, which added that the operating income for the period represents a return of 3.7 percent on average power investment, including allocations to power of a proportionate part of the cost of multi-purpose facilities. At the end of fiscal 1944 approximately $395,000,000 had been expended on TVA power facilities.

One distribution agency was added during the year, bringing the total to 129, of which 84 are municipal and 45 cooperative systems, serving 550,000 domestic, farm, commercial, industrial and other consumers. Gross revenues of these distributors reached almost $36,500,000 with a combined net income of more than $6,360,000. All but nine of the distributing agencies sold at or below standard TVA resale rates.

Consumers on these systems increased 4 percent during the year, and the number of commercial or small light and power consumers, which had declined markedly during the preceding fiscal year, increased by 5 percent. Distribution by these systems totaled 2,906,714,000 kw.-hr.

Two major dams, Kentucky on the Tennessee River near its confluence with the Ohio, and Fontana at the opposite end of the system, were closed shortly after the end of the fiscal year. No further construction was done on Watauga or South Holston Dams.

Additions to installed capacity totaled 254,000 kw., bringing the system total almost to 2,000,000 kw. The first of four 32,000 kw. units at Kentucky was operating by mid-September, the second a month later. The third and fourth are scheduled for operation in March and July of this year.

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Generating capacity installations during fiscal 1944 at projects already in operation totaled 115,000 kw., including the fourth and fifth 30,000-kw. machines at Watts Bar Dam, the 14th 25,200-kw. unit at Wilson Dam and the second 30,000-kw. unit at Douglas Dam. At the Watts Bar steam plant, work was resumed on the fourth 60,000-kw. machine, which was reinstated by WPB in November, 1943.

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Erie Stores Will Light Up to End Wave of Robberies

Protective inside lighting of stores at night will be resumed at Erie, Pa., to combat a recent wave of burglaries and safe cracking. Mayor Charles R. Barber has removed the restrictions on such lighting which were placed soon after the outbreak of the war.

West Penn Co-ops Plan $500,000 Rural Program

Light and power will be available to about 15,000 farms after the war when more than 1,400 miles of new electric lines will be erected in rural areas of Western Pennsylvania.

Farm cooperative groups in this area, organized under the Rural Electrification Administration, plan to spend more than $500,000 for transmission and distribution lines, poles, transformers and other equipment.

Western Pennsylvania's co-ops are getting a head start in post-war farm electrification by mapping detailed plans for lines and consumer service and by preparing equipment orders for manufacturers.

Central Electric Cooperative, Inc., Parkers Landing, plans to erect 35 miles of lines in Armstrong County at a cost of $35,000.

Southwest-Central Rural Cooperative, Indiana, proposes to erect 800 miles of lines to serve 2,500 new consumers.

Eighty-two miles of REA lines will be built in Somerset County by the Somerset Rural Electric Cooperative at a cost of $82,000. Another 126 miles of lines will be strung in Clearfield County by the Central Rural Electric Cooperative Association, with an expenditure of $126,000.

In Huntington County, Valley Rural Electric Cooperative will erect 148 miles of line, spending $148,000. Warren Electric Cooperative plans 131 miles of power facilities in Warren County at a cost of $131,000.

Other projects are planned by REA cooperatives in Indiana, Jefferson and Bedford Counties, adding three or four hundred more miles of lines.

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San Diego Gas & Electric Gives Training Program

Two hundred and twenty superintendents, foremen, and supervisors of the San Diego Gas & Electric Co. are now receiving a special supervisory training program in conjunction with the "Training Within Industry" program sponsored throughout the nation by the War Manpower Commission. The course has been designed to increase production through a better understanding of the human elements involved in job relations.

A "Four Step Method" is outlined as a pattern to be used by supervisors in the handling of all personnel problems. It is: (1) get the facts; (2) weigh and decide; (3) take action; and (4) don't pass the buck.

The entire course consumes ten hours, with classes held two hours each day, five days a week. Attendance is limited to ten persons, a size which permits free discussion of all questions which arise. Each student is required to bring into the meeting one personnel problem to be submitted for study and open discussion. The "Four Step Method" is then applied to the problem, giving everyone a practical demonstration of the method in action.

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Charles Weiler Becomes Deputy Director of OWU

Charles F. Weiler, since last April assistant to Edward Falck, director of the Office of War Utilities, has been named deputy director of OWU and his job as assistant to the director filled by Herschel F. Jones.

Formerly chief statistician for the Wisconsin Telephone Co., Milwaukee, Weiler came to WPB in June, 1942, and was chief of OWU's Materials Control Branch before becoming assistant to Falck.

Jones was an accountant for the Michigan Bell Telephone Co., from 1929 until 1932. He did research work on the electric power industry and water utilities in Nebraska from 1937-1939 and was later a member of the faculty of the Illinois Institute of Technology in its Industrial Engineering Department. In 1940 and 1941, he was a fellow of the Social Science Research Council, and in 1942 was awarded a Ph.D. in Economics by the University of Wisconsin. He entered government service that year and was with the Office of Civilian Supply, Smaller War Plants Corp., and Alien Property Custodian before joining WPB's Program Bureau where he was liaison officer to OWU.

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Eastern Shore Spending $270,000 for Better Lines

Transmission improvements to lines of the Eastern Shore Public Service Co. are underway at a cost of approximately $270,000.

A new high voltage transmission line from the generation plant at Vienna, Md., to Delmar, Del., will cost about $200,000. Voltage of the transmission line from Salisbury to the Worcester County switching station near Berlin, Md., will be increased at the cost of $70,000.

The program is tied in with the expansion of generating facilities of the Vienna plant and increases the capacity of the entire system.

Supreme Court to Hear Rate Case Arguments

Will Decide Right of FPC to Exclude Inter-Company Profits from Utility Rate Base

The Supreme Court agreed this week to hear argument on whether the Federal Power Commission properly may exclude intercompany profits from a rate base.

The decision came as the high court vacated its order of November 13 in which it had refused to hear any question in the pending case, except one relating to cost allocation, and agreed to hear argument on three other points it originally dismissed. The case was that of the Canadian River Gas Co. vs. the Federal Power Commission. In addition to the cost allocation question, the court will hear argument on:

1. Whether FPC, in fixing the interstate wholesale rate for natural gas sold by Canadian River, may properly consider the investment in facilities for gathering and production of natural gas.

2. If it may consider such investment, whether FPC, in determining a rate base allowance for such items may include them at cost or whether it must include them at the company's or other valuation.

3. Whether, if FPC may consider such facilities and include them in the rate base at cost, FPC may exclude from the rate base $3,000,000 in intercompany profits.

May Exclude Reproduction Cost

The Supreme Court's action in expanding the scope of the appeal did not affect its action in upholding by default FPC's right to exclude evidence of reproduction cost. In the Canadian River case, FPC received reproduction cost evidence but gave it no weight in reaching its decision.

Possibility that the reproduction-cost-evidence-exclusion question may yet be heard was seen in the fact that the Panhandle Eastern Pipeline Co. has filed an appeal for rehearing and expanding of the questions to be reviewed similar to that granted Canadian River this week. It was in limiting the Panhandle Eastern review to a question of cost allocation that the court, in refusing to hear argument on other questions, upheld by default FPC's right to exclude reproduction cost evidence.

The court, meanwhile, was to hear later this week arguments in the case of the Connecticut Light & Power Co. vs. FPC. The company is appealing from an FPC order which held it a public utility under the meaning of the Federal Power Act because of ownership of facilities for transmission of electric energy in interstate commerce. John E. Benton, solicitor of the National Association of Railroad and Utilities Commissioners, was to appear amicus curiae arguing against affirmation of the FPC's order. Francis Shea, an assistant attorney general, was to argue the case for FPC.

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R. H. O'Brien Quits SEC to Work with Paramount

The resignation of Robert H. O'Brien as a member of the Securities and Exchange Commission has been accepted by President Roosevelt who wrote in accepting the resignation that O'Brien's "work over the years with the Commission has been an outstanding example of public service."

O'Brien, who gave "pressing personal reasons" as the cause of his resignation, has since announced that he will become special assistant to Barney Balaban, president of Paramount Pictures, Inc.

O'Brien entered government service in 1934 as a PWA attorney and joined SEC in February, 1942.

Nebraska Power Co. Sells for $14,421,000

Sale of the entire common stock of the Nebraska Power Co. by its parent, American Power & Light Co., to a non-profit corporation of Nebraska citizens (ELECTRICAL WORLD, December 23, 1944, Page 81) has been completed at a sale price of $14,421,000. Financing of the transaction was arranged by a group of investment bankers headed by John Nuveen & Co. of Chicago and B. J. Van Ingen & Co., Inc., New York.

The transfer to the non-profit group will be financed by the issuance of revenue bonds. In addition, Nebraska Power's preferred stock will be retired at 110 and accrued dividends, and its debentures and bonds will be redeemed at applicable call prices and accrued interest with dissolution of the company to follow immediately thereafter.

The immediate public financing which will result from the deal will be in the form of $15,600,000 of Loup River Public Power District Eastern Division refunding bonds, maturing in from six months to twelve years. It is expected that bids will be called for on the bonds around January 9.

NO ACCIDENTS, NO LOST TIME—In September, 1939, a meter reader of the Sunnyside, Wash., district of the Pacific Power & Light Co., jumped a fence, sprained a knee, and had the last disabling injury or lost time accident that the district has had in over five years. The 16-man crew servicing 5,000 customers, 2,200 on farms, consists of 11 men who have been with the company 15 years, 3 eight years, and 2 newcomers. Part of the crew are, front row, left to right, Cecil Hudlow, line superintendent, and Alfred Erz, head groundman. Rear row, same order, Linemen James Richey, Herb Woods, Ronald Nelson, and George Minnich; J. C. Hamilton, district manager; James Davenport, crew foreman; Art Pursell and John Rogers, servicemen

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Two hundred and twenty superintendents, foremen, and supervisors of the San Diego Gas & Electric Co. are now receiving a special supervisory training program in conjunction with the "Training Within Industry" program sponsored throughout the nation by the War Manpower Commission. The course has been designed to increase production through a better understanding of the human elements involved in job relations.

A "Four Step Method" is outlined as a pattern to be used by supervisors in the handling of all personnel problems. It is: (1) get the facts; (2) weigh and decide; (3) take action; and (4) don't pass the buck.

The entire course consumes ten hours, with classes held two hours each day, five days a week. Attendance is limited to ten persons, a size which permits free discussion of all questions which arise. Each student is required to bring into the meeting one personnel problem to be submitted for study and open discussion. The "Four Step Method" is then applied to the problem, giving everyone a practical demonstration of the method in action.

•

Charles Weiler Becomes Deputy Director of OWU

Charles F. Weiler, since last April assistant to Edward Falck, director of the Office of War Utilities, has been named deputy director of OWU and his job as assistant to the director filled by Herschel F. Jones.

Formerly chief statistician for the Wisconsin Telephone Co., Milwaukee, Weiler came to WPB in June, 1942, and was chief of OWU's Materials Control Branch before becoming assistant to Falck.

Jones was an accountant for the Michigan Bell Telephone Co., from 1929 until 1932. He did research work on the electric power industry and water utilities in Nebraska from 1937-1939 and was later a member of the faculty of the Illinois Institute of Technology in its Industrial Engineering Department. In 1940 and 1941, he was a fellow of the Social Science Research Council, and in 1942 was awarded a Ph.D. in Economics by the University of Wisconsin. He entered government service that year and was with the Office of Civilian Supply, Smaller War Plants Corp., and Alien Property Custodian before joining WPB's Program Bureau where he was liaison officer to OWU.

•

Eastern Shore Spending $270,000 for Better Lines

Transmission improvements to lines of the Eastern Shore Public Service Co. are underway at a cost of approximately $270,000.

A new high voltage transmission line from the generation plant at Vienna, Md., to Delmar, Del., will cost about $200,000. Voltage of the transmission line from Salisbury to the Worcester County switching station near Berlin, Md., will be increased at the cost of $70,000.

The program is tied in with the expansion of generating facilities of the Vienna plant and increases the capacity of the entire system.

Supreme Court to Hear Rate Case Arguments

Will Decide Right of FPC to Exclude Inter-Company Profits from Utility Rate Base

The Supreme Court agreed this week to hear argument on whether the Federal Power Commission properly may exclude intercompany profits from a rate base.

The decision came as the high court vacated its order of November 13 in which it had refused to hear any question in the pending case, except one relating to cost allocation, and agreed to hear argument on three other points it originally dismissed. The case was that of the Canadian River Gas Co. vs. the Federal Power Commission. In addition to the cost allocation question, the court will hear argument on:

1. Whether FPC, in fixing the interstate wholesale rate for natural gas sold by Canadian River, may properly consider the investment in facilities for gathering and production of natural gas.

2. If it may consider such investment, whether FPC, in determining a rate base allowance for such items may include them at cost or whether it must include them at the company's or other valuation.

3. Whether, if FPC may consider such facilities and include them in the rate base at cost, FPC may exclude from the rate base $3,000,000 in intercompany profits.

May Exclude Reproduction Cost

The Supreme Court's action in expanding the scope of the appeal did not affect its action in upholding by default FPC's right to exclude evidence of reproduction cost. In the Canadian River case, FPC received reproduction cost evidence but gave it no weight in reaching its decision.

Possibility that the reproduction-cost-evidence-exclusion question may yet be heard was seen in the fact that the Panhandle Eastern Pipeline Co. has filed an appeal for rehearing and expanding of the questions to be reviewed similar to that granted Canadian River this week. It was in limiting the Panhandle Eastern review to a question of cost allocation that the court, in refusing to hear argument on other questions, upheld by default FPC's right to exclude reproduction cost evidence.

The court, meanwhile, was to hear later this week arguments in the case of the Connecticut Light & Power Co. vs. FPC. The company is appealing from an FPC order which held it a public utility under the meaning of the Federal Power Act because of ownership of facilities for transmission of electric energy in interstate commerce. John E. Benton, solicitor of the National Association of Railroad and Utilities Commissioners, was to appear amicus curiae arguing against affirmation of the FPC's order. Francis Shea, an assistant attorney general, was to argue the case for FPC.

•

R. H. O'Brien Quits SEC to Work with Paramount

The resignation of Robert H. O'Brien as a member of the Securities and Exchange Commission has been accepted by President Roosevelt who wrote in accepting the resignation that O'Brien's "work over the years with the Commission has been an outstanding example of public service."

O'Brien, who gave "pressing personal reasons" as the cause of his resignation, has since announced that he will become special assistant to Barney Balaban, president of Paramount Pictures, Inc.

O'Brien entered government service in 1934 as a PWA attorney and joined SEC in February, 1942.

Nebraska Power Co. Sells for $14,421,000

Sale of the entire common stock of the Nebraska Power Co. by its parent, American Power & Light Co., to a non-profit corporation of Nebraska citizens (ELECTRICAL WORLD, December 23, 1944, Page 81) has been completed at a sale price of $14,421,000. Financing of the transaction was arranged by a group of investment bankers headed by John Nuveen & Co. of Chicago and B. J. Van Ingen & Co., Inc., New York.

The transfer to the non-profit group will be financed by the issuance of revenue bonds. In addition, Nebraska Power's preferred stock will be retired at 110 and accrued dividends, and its debentures and bonds will be redeemed at applicable call prices and accrued interest with dissolution of the company to follow immediately thereafter.

The immediate public financing which will result from the deal will be in the form of $15,600,000 of Loup River Public Power District Eastern Division refunding bonds, maturing in from six months to twelve years. It is expected that bids will be called for on the bonds around January 9.

NO ACCIDENTS, NO LOST TIME—In September, 1939, a meter reader of the Sunnyside, Wash., district of the Pacific Power & Light Co., jumped a fence, sprained a knee, and had the last disabling injury or lost time accident that the district has had in over five years. The 16-man crew servicing 5,000 customers, 2,200 on farms, consists of 11 men who have been with the company 15 years, 3 eight years, and 2 newcomers. Part of the crew are, front row, left to right, Cecil Hudlow, line superintendent, and Alfred Erz, head groundman. Rear row, same order, Linemen James Richey, Herb Woods, Ronald Nelson, and George Minnich; J. C. Hamilton, district manager; James Davenport, crew foreman; Art Pursell and John Rogers, servicemen

Directors of the new company are Dr. B. H. Baer, Gerald Collins, J. E. Davidson, W. C. Fraser, Edward F. Leary, T. H. Maenner, W. W. Wenstrand, Emil Wolf, and Don B. Woodyard.

These directors have elected the following company officers, T. H. Maenner, chairman of the board; J. E. Davidson, president; Don B. Woodyard, Roy Page, and F. E. Smith, vice-presidents; E. F. Leary, secretary; F. J. Moylan, assistant secretary; Gerald Collins, treasurer; and T. F. Hanley, assistant treasurer.

•

Beryllium Causes Lung Disease, Doctor Testifies

Dr. Leroy Gardner, Peabody, Mass., recently testified before Commissioner Cyrus C. Rounseville of the Massachusetts Industrial Accident Board that beryllium powder used in the manufacture of fluorescent tubes is toxic and causes pulmonary disease. The hearings were held in the cases of five girls employed by the Sylvania Electric Products Co., Salem, Mass.

Helen Spates, Rita Gagnon, Mary Comardo, Margaret Shonfield and Isoline Pais are plaintiffs in the case to obtain compensation and hearings were held to show these girls incurred sarcoidosis, a lung disease, in connection with their work at the Salem plant in 1940 and 1941. The Pais girl is now dead.

Dr. John F. Bradley, Peabody, testified he examined five cases of employees and visited three. He stated specifically that Helen Spates' condition in his opinion is due to occupation at the plant.

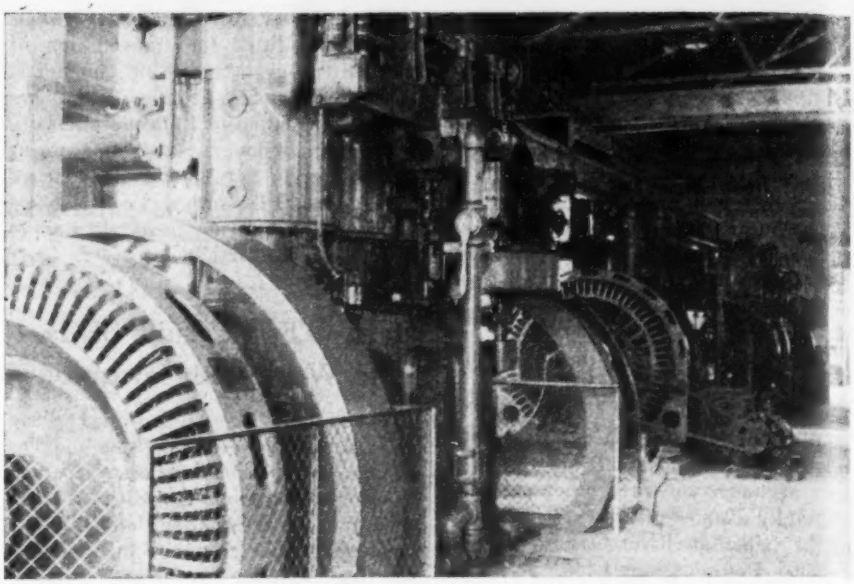
•

BPA to Move Southward for Post-War Shasta Tie-in

Plans of Bonneville Power Administration to extend its service to the south with a view of establishing a post-war hook-up with Shasta Dam power in northern California were disclosed in Klamath Falls, Ore., recently by an Administration official.

Making the disclosure was Dr. R. B. Thompson, consultant and public ownership worker for Bonneville, who stated that an item for line extension from Eugene, Ore., to the north, and Klamath Falls would be included in the next Bonneville budget. The latter town is immediately north of the California border.

Dr. Thompson said that the new line would not be built until after the war, but that it would eventually become a part of the Shasta link.



KENTUCKY EDISON GENERATORS—Three of the eight generators of the Kentucky Edison Co. at its generating station at Stanton, Ky., are shown above. In the November 25 issue, "Electrical World," a story concerning the application which the company has filed with the Kentucky Public Service Commission for an interconnection with lines of the Kentucky Utilities Co. stated in error that Kentucky Edison depended "upon a lone gas-powered generator"

Wisconsin Power & Light Plans Generator Addition

Equipment is to be ordered immediately and construction will be started early in 1945 on a 25,000-kw. addition to the Beloit, Wis., generating station of Wisconsin Power & Light Co. it was announced recently by G. C. Neff, president.

The addition will include a 25,000-kw. hydrogen-cooled, 3,600 r.p.m. turbo-generator operating on steam at 850 psi., 900 deg. Plans call also for installation of a 275,000 lb. per hr. steam generator burning pulverized coal. The project also include auxiliary power plant equipment and building to house the new equipment.

This generating capacity will be connected to the company's transmission system through a 20,000-kva. substation which will be constructed as part of the project. Sargent & Lundy, Chicago, are the consulting engineers.

•

Montreal Wins Increased Levy from Commission

An agreement for increased valuation of real estate for municipal tax purposes has been reached by the Quebec Hydro-Electric Commission, Montreal Light, Heat & Power Consolidated, and the City of Montreal.

Under the agreement, valuation of real estate assets now held by Quebec Hydro has been increased to $16,500,000 from $9,000,000, and the city will collect $4,500,000 in extra taxes for the next 20 years. Montreal Light, expropriated last year by the Quebec government, has agreed to take care of the higher tax levy from 1941, when the city first made a claim for a tax increase, until 1944, and Quebec Hydro will be responsible for payment from that year on.

•

New 110-Kv. Tie-in Planned for Sarnia-Ontario System

An additional 110-kv. line connecting the lines of the Ontario Hydro-Electric Commission with those of its customer, Sarnia Hydro-Electric Commission, is expected to be in operation by Spring. The new line, costing approximately $100,000, will extend from Chatham to Sarnia via Wallaceburg. The present 110-kv. line runs from St. Thomas via Alvinston.

•

Western United Will Sell Gas Properties in Illinois

Western United Gas & Electric Co., Aurora, Ill., has applied to the Illinois Commerce Commission for consent to sell its gas and electric properties in Murphysboro and its gas properties in 12 other communities in Jackson, Williamson, Franklin and Perry counties, Illinois, to the Illinois Electric & Gas Co., Chicago for $825,000. The sale will be made upon approval of the transaction by the state commission.

TVA "Tax" Payments Total $2,168,824 in '44

Recommending that its payments in lieu of taxes to state and municipal sub-divisions be continued because they are "a reasonable cost of the power program," the Tennessee Valley Authority, in a special report to Congress, disclosed that payments in 1944 to six states and 126 counties exceeded ad valorem taxes paid on all properties purchased.

The report was required by Congress when in 1940 it amended Sec. 13 of the TVA Act specifying amount and manner of payments. It disclosed that "schools generally receive the largest share of TVA payments to counties, followed in order by general purposes, debt service and roads."

Payments in lieu of taxes in 1944 were boosted by the war-born expansion of TVA's power business to $2,168,824, or $669,407 above payments in 1941 despite the fact that the rate of payment, under the Act, has been graduated downward from the 10 percent of gross proceeds payable in 1941 toward the 5 percent payable in 1949 and yearly thereafter.

When payments in lieu of taxes on land allocated to purposes other than power are included, the report showed, 1944 payments were $790,311 above the total of ad valorem taxes levied against the property before it was acquired by TVA. The report adds that payments in lieu of taxes have exceeded the minimum statutory payment, which is based on ad valorem tax yield of TVA power properties, including reservoir space allocated to power, before they were acquired by TVA, by amounts ranging from 44 percent in 1941 to 80 percent in 1944.

In the fiscal year ended June 30, 1943, the report states, TVA's 128 municipal and cooperative distribution systems paid local governments $1,957,614, or 5.6 percent of their gross revenues, with these payments exceeding former ad valorem taxes on properties before their acquisition by their present owners by about $400,000.

Being a federal operation, TVA pays no taxes upon income.

•

Signs Union Agreement

Commonwealth Edison Co. has signed a collective bargaining agreement with four locals of the International Brotherhood of Electrical Workers, American Federation of Labor, covering the company's production and maintenance employees. Major provisions of the contract provide that no employee must join the union but that all who join must maintain membership until the contract expires, that ability and seniority are to be considered in promotions, that newly established schedules for overtime pay, vacations be followed.

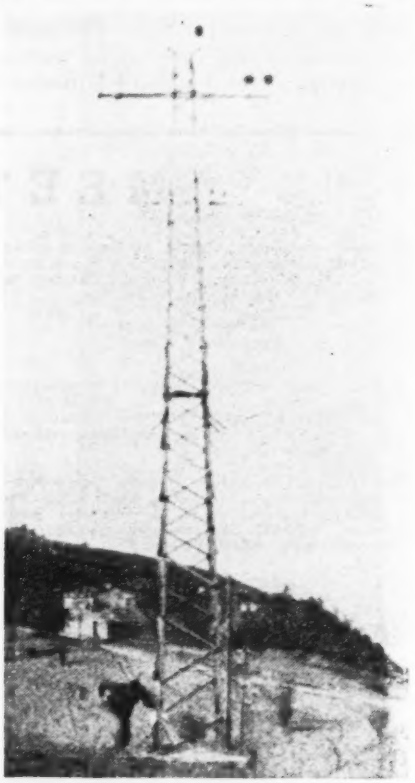
•

Louisville Utility Writes Off $6,522,714 in Accounts

Louisville Gas & Electric Co., with the approval of the Federal Power Commission, will eliminate $6,522,714 in write-ups and other excess over original cost from its plant accounts. From the electric plant accounts, $6,075,538 will be written off, and the other $447,176 will be from the gas plant accounts.

The elimination of $1,650,469 will be effected by charges to reserve for depreciation and other specified accounts and of $4,872,245 by amortization by equal annual charges over a 15-year period beginning January 1, 1944.

Previous elimination of $15,144,969, principally from the electric plant accounts of the company, brings to a total of $21,667,683 the adjustments made in the company's books.



SABOTEUR AT WORK—Behind the advancing Allied armies in Italy, partisans spread destruction to hinder the Germans. Here a patriot is shown fleeing after placing an explosive charge against an electrical pylon

Young, Swope Retire As Directors of GE

Both Have Served Since 1922—War Brought Them from Retirement to Take over Old Positions

After serving 22 years as directors of the General Electric Co., Owen D. Young and Gerard Swope have resigned. Both were elected directors on May 16, 1922, when Mr. Young became chairman of the board, and Mr. Swope, president of the company.

Both men retired from their respective offices on January 1, 1940, and were succeeded by Philip D. Reed as chairman and Charles E. Wilson as president. When these men entered war service in 1942, Mr. Young and Mr. Swope took up their former duties and continued until September 8, 1944.

Mr. Young, a native of Van Hornesville, N. Y., was born on October, 27, 1874. He entered the employ of General Electric on January 1, 1913, succeeding the late Hinsdill Parsons, vice-president and general counsel for the company. When Charles A. Coffin resigned as chairman of the board in May, 1922, Mr. Young was elected to succeed him.

Mr. Swope was born in St. Louis, Mo., December 1, 1872. His first job with General Electric was in 1893, as a $1 a day helper in the Chicago service shop. Upon graduation from the Massachusetts Institute of Technology, he accepted a position with the Western Electric Co. but in 1919 returned to General Electric and was elected first president of the International General Electric Co., a position he held until May, 1922, when elected president of the General Electric Co. Since April, 1927, he has served as chairman of the board of the International General Electric Co.

•

BPA Reveals $50,000,000 Sales for 5-Year Period

Gross revenue of $50,000,000 for sale of over 21,000,000,000 kw.-hr. of electrical power generated at Bonneville and Grand Coulee plants during the last five years to December, 1944, was announced recently by Bonneville Power Administrator Paul J. Raver.

Net surplus amounted to $12,000,000 in five years after payment of power costs, operation and maintenance expenses, depreciation costs and interest on Bonneville-Grand Coulee power transmission grid and power facilities at the two Columbia River plants, according to Mr. Raver.

Revenue has been derived from sale

of power to war industries, military establishments, private utilities and public agencies in the Pacific northwest. The Federal transmission now includes 55 substations and 2,700 miles of high voltage lines, it was reported.

•

Ontario Hydro Buys Northern Ontario Co.

Northern Ontario Power Co., one of the last privately-owned power companies in Ontario, has been sold to the Hydro-Electric Power Commission of Ontario for $12,500,000 as of November 30, 1944. Northern Ontario is a subsidiary of Canada Northern Power Co. which also owns the Quebec Northern Power Co.

The sale includes all of the assets of Northern Ontario including eight hydroelectric plants, most of them on the Montreal River flowing into Lake Temiskaming; the Hound Chutes compressed air power plant, one of the few remaining plants of this kind still in existence; 739 miles of transmission lines; 157 miles of distribution lines; and 421 miles of telephone lines.

Communities served include Cobalt, Haileybury, New Liskeard, Englehart, Timmins, Thornloe, and the company also supplies power to mining camps in Porcupine, South Porcupine, Cobalt, and Kirkland Lake districts.

The $12,500,000 purchase price will be paid in two bond issues, both dated January 1, 1945. One will be a $5,000,000 issue of five-year bonds bearing interest at 2 percent; the other a $7,500,000 issue of 15-year bonds bearing interest at 3 percent and callable at any time after 1945.

•

Quebec Power Co. Buys Small Distribution System

Quebec Power Co. has bought the distribution and sales system of the Corporation Electrique de Ste. Catherine in Portneuf County for $65,000. The corporation distributed electricity at Ste. Catherine, Lake St. Joseph, and St. Augustin.

•

Signs 5-Year City Contract

Southern Indiana Gas & Electric Co. has signed a five-year contract expiring December 31, 1949, with Mt. Vernon, Ind., for ornamental and overhead street lighting. The company agreed to rebuild completely both systems as soon as government approval can be obtained.

Adequate Wiring Bureau to Exhibit at Exposition

To assist builders of post-war homes by showing them how adequate wiring will help them meet public demand for automatic features in all sizes and types of homes, the National Adequate Wiring Bureau will participate in the Exposition of the National Association of Home Builders, January 15 to 18 at Chicago.

The bureau will feature adequate wiring layouts for six prize-winning home designs which will be on display. In addition to the wiring layouts, the Adequate Wiring exhibit will demonstrate the electrical sales features gained for each home by adequate wiring.

•

3,000,000-Kw. Generating Rise Planned by British

British utility companies will spend £90,000,000 to increase generating capacity by over 3,000,000 kw. for meeting the demand for electricity expected after the end of the war up to the winter of 1948.

The Central Electricity Board has approved the program, and under the Electricity (Supply) Act of 1926 and with the approval of the Electricity Commisioners, has directed the owners of existing selected stations to proceed with the installation of some 900,000 kw. by the winter of 1946 and some further 340,000 kw. by the winter of 1947.

Three new stations will also be built with an aggregate capacity of 270,000 kw. by the winter of 1947.

•

Wheeling Electric to Drop $199,337 from Accounts

Wheeling Electric Co. with approval of the Federal Power Commission will eliminate from its electric plant accounts $199,337 representing the profit on fees paid to its associate, American Gas & Electric Co., for engineering and supervision on construction. The profit has been determined to be approximately 60 percent of the gross fees; the elimination will be effected by a charge to earned surplus.

•

Insull Debenture Holders Receive 90¢ on $1,000

With a recent payment of 56 cents for each $1,000 invested, debenture holders of the bankrupt Insull Utility Investment, Inc. will realize in all 90 cents for each $1,000 invested. Louis F. Jacobson, attorney for the creditors, said that litigation has been concluded by the recent payment authorized by the Federal Court at Chicago.

MEETINGS

Pennsylvania Electric Association—Systems operation committee, Penn Alto Hotel, Altoona, January 30-31. A. R. Deck, chairman, Metropolitan Edison Co., Reading, Pa.

Previously Listed

National Rural Electric Cooperative Association—Annual convention, Plaza Hotel and Municipal Auditorium, San Antonio, Texas, January 16-17. Avery C. Moore, secretary-treasurer, 416 5th St., N.W., Washington 1, D. C.

Dielectric and Induction Heating Conference—Sponsored by Great Lakes Power Club and Chicago Lighting Institute, Marquette Auditorium, 140 So. Dearborn St., Chicago, Ill., January 16-18. C. W. Zersen, Conference Committee, 72 West Adams St., Chicago 3, Ill.

Missouri Valley Electric Association—Annual power sales conference, Continental Hotel, Kansas City, Mo., January 17-18. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln 8, Neb.

American Society of Civil Engineers — Annual meeting, Commodore Hotel, New York, N. Y., January 17-19. George T. Seabury, secretary, 33 West 39th St., New York 18, N. Y.

Canadian Electrical Association — Annual winter conference, Mount Royal Hotel, Montreal, January 18-19; annual Western conference, Hotel Vancouver, Vancouver, B. C., March 15-16. B. C. Fairchild, managing director, 704 Tramways Bldg., Montreal 1, Que.

Industrial Electrochemical Conference — Museum of Science & Industry, 57th St. and Lake Michigan Ave., Chicago, Ill., January 19. O. W. Storey, chairman of publicity committee, C. F. Burgess Laboratories, Inc., 180 N. Wabash Ave., Chicago 1, Ill.

American Institute of Electrical Engineers—National technical meeting, Engineering Societies Bldg., New York, N. Y., January 22-26. H. H. Henline, secretary, 33 West 39th St., New York 18, N. Y.

Institute of Radio Engineers — Winter technical meeting, Hotel Commodore, New York, N. Y., January 24-27. W. B. Cowilich, secretary, 330 W. 42nd St., New York 18, N. Y.

National Association of Purchasing Agents—Public Utility Buyers' Group mid-winter meeting, Wm. Penn Hotel, Pittsburgh, Pa., February 1-2. J. K. Hall, chairman, Columbus & Southern Ohio Electric Co., Columbus 15, Ohio.

Pennsylvania Electric Association—Electrical equipment committee, Hotel Roosevelt, Pittsburgh, Pa., February 8-9. B. E. Hagy, chairman, Philadelphia Electric Co., 900 Sansom St., Philadelphia, Pa.

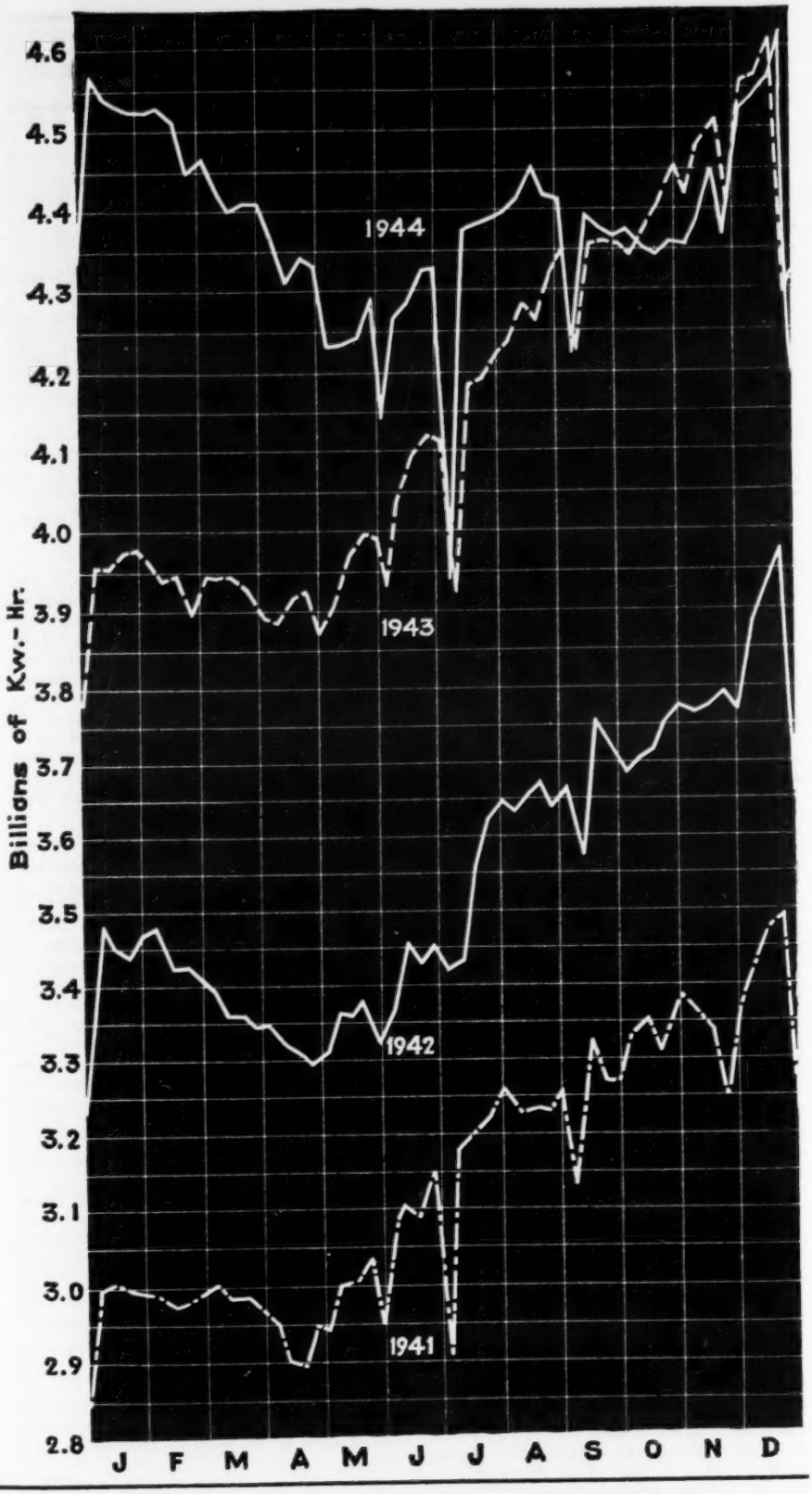
Edison Electric Institute — Accident prevention committee, Cleveland Hotel, Cleveland, Ohio, February 8-9; electrical equipment committee, Netherland Plaza Hotel, Cincinnati, Ohio, February 13-14; transmission and distribution committee, Wm. Penn Hotel, Pittsburgh, Pa., February 15-16; commercial meetings, Edgewater Beach Hotel, Chicago, Ill., March 27-29. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

American Society for Testing Materials—Committee week, Wm. Penn Hotel, Pittsburgh, Pa., February 26-March 2 (spring meeting, February 28). R. J. Painter, assistant to the secretary, 260 S. Broad St., Philadelphia 2, Pa.

Electric Output Curve Takes Sharp Drop

The electric output curve moved sharply downward during the week ended December 30, 1944, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry amounted to 4,225,814,000 kw.-hr., as compared with 4,616,975,000 kw.-hr. the preceding week ended December 23, 1944. Figures for the week represented a decrease of 2.6 percent under the 4,337,387,000 kw.-hr. distributed during the corresponding week a year ago. This is the largest decrease reported as compared with the preceding year, the previous high loss being reported for the last week in October when the percent change amounted to a loss of 2.1 percent.

Four of the major geographic regions reported decreases, the Rocky Mountain states showing a drop of 12.4 percent; the Mid-Atlantic group of 5.1 percent, the Pacific Coast of 3.8 and the Southern States of 1.7 percent. The West Central States showed a gain of 6.4 percent, the highest increase reported. The other gains were unsubstantial.



Weekly Output Millions Kw.-Hr.

1944		1943		1942	
Dec. 30	4,226	Jan. 1	4,337*	Jan 2	3,780†
Dec. 23	4,617	Dec. 25	4,295	Dec. 26	3,656
Dec. 16	4,563	Dec. 18	4,613	Dec. 19	3,976
Dec. 9	4,538	Dec. 11	4,567	Dec. 12	3,938
Dec. 2	4,524	Dec. 4	4,560	Dec. 5	3,884
Nov. 25	4,369	Nov. 27	4,403	Nov. 28	3,766
Nov. 18	4,450	Nov. 20	4,513	Nov. 21	3,795
Nov. 11	4,397	Nov. 13	4,483	Nov. 14	3,776
Nov. 4	4,355	Nov. 6	4,414	Nov. 7	3,762
Oct. 28	4,358	Oct. 30	4,453	Oct. 31	3,775
Oct. 21	4,345	Oct. 23	4,415	Oct. 24	3,753
Oct. 14	4,355	Oct. 16	4,382	Oct. 17	3,717
Oct. 7	4,375	Oct. 9	4,342	Oct. 10	3,702

* 1944
† 1943

Percent Change from Previous Year

	Week Ending		
	Dec. 30	Dec. 23	Dec. 16
New England	+ 0.4	.....	+ 1.3
Mid Atlantic	— 5.1	.....	— 4.0
Central Industrial	+ 0.7	.....	+ 1.6
West Central	+ 6.4	.....	+ 9.4
Southern States	— 1.7	.....	+ 2.0
Rocky Mountain	—12.4	.....	—10.4
Pacific Coast	— 3.8	.....	—.4.6
Total United States	— 2.6	.....	— 1.1

Over-Age Men Need Not Pay Pension Deductions

Pacific Gas & Electric Co. was ordered to discontinue deducting retirement income payments from the wages of employees who remain in service beyond their normal retirement age in a recent decision of the Tenth Regional War Labor Board in San Francisco.

Involving 101 operating employees in the East Bay, North Bay, San Jose and San Francisco divisions of the company, the board's action decided a dispute between P. G. & E. and the Utility Workers Organizing Committee, Local 133 (CIO). The utility also must restore all deductions made subsequent to March 18, 1944.

Finding that "retirement income is an annuity and separate from wages," the directive order held that the deductions constituted a reduction in salaries of employees who had reached retirement age under a company plan but who had continued in their jobs as a result of manpower shortage.

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission, in a series of orders recently issued affecting electric utility companies:

APPROVED ISSUANCE and sale of $8,000,000 principal amount of 2½ percent serial notes of Northern Indiana Public Service Co. in equal amounts to the Chase National Bank of New York and the Prudential Insurance Co. of America. Northern Indiana will use the proceeds to prepay a 1½ percent promissory note for $1,200,000, $3,000,000 of 2⅞ percent serial notes and $3,800,000 of 2¾ percent serial notes. The company reported to the commission that the refinancing will result in an annual interest savings of $122,750.

HAS GRANTED request by Kansas Power & Light Co., Topeka, for an order declaring its sale of the water plant and distribution system serving Hutchinson, Kan., a necessary step in the integration of this holding company system. The company is a subsidiary of the North American Light & Power Co. Kansas Power & Light is selling the Hutchinson properties for $940,000 to Amos Small of Wichita. Proceeds are to be deposited with the trustees under the indenture securing its 3½ percent first mortgage bonds due 1969.

HAS AUTHORIZED Central Vermont Public Service Corp. to acquire the common stock and a promissory note of Vermont Utilities, Inc., Chester, Vt., for $512,000 from the Colonial Utilities Corp., New York. The commission required that Central Vermont dispose of Vermont Utilities' telephone properties and merge Vermont Utilities with itself within one year. The commission also required that Central Vermont create a reserve by charging to earned surplus the difference between the purchase price and the amount of Vermont Utilities' net assets.

HAS APPROVED the Columbia Gas & Electric Corp.'s proposed entry on its books of $46,993,553 to represent its investment in common stock of the Manufacturers Light & Heat Co., Pittsburgh.

GRANTED ADDITIONAL two months to the Associated Electric Co. and a subsidiary, the Missouri Southern Public Service Co., in which to complete the sale of Missouri Southern's properties in Barry, McDonald and Newton Counties, Mo., to New-Mac Electric Cooperative, Inc. The extension will expire on March 2, 1945.

GAVE PERMISSION to the Mississippi Power Co., a subsidiary of Commonwealth & Southern Corp., to redeem all of its outstanding 18,264 shares of $7 preferred stock of $100 par value, at the redemption price of $110 a share plus accrued dividends. Certain restrictions were imposed in connection with the redemption plan by the commission on the payment by Mississippi of dividends on its common stock.

HAS APPROVED a plan providing for the dissolution of the California Public Service Co. following a series of transactions and the distribution of the residual assets to its parent, the Peoples Light & Power Co. As part of the plan, California Public Service will sell to the California Oregon Power Co. certain electric properties in California for a base cash price of $470,000 and sell to the Pacific Gas & Electric Co. other properties in exchange for 14,000 shares of Pacific's 6 percent cumulative first preferred stock, $25 par value. California Public Service then will sell the 14,000 shares of Pacific preferred to the Provident Mutual Life Insurance Co. of Philadelphia for $521,500, or $37.25 a share and in turn redeem all of California Public Service's 4¼ percent first mortgage bonds, series B, due 1964, held in face amount of $574,000 by Provident Mutual. California Public Service in final steps of the plan will pay all remaining debts and distribute its remaining assets to Peoples.

Applications Filed

CENTRAL OHIO LIGHT & POWER CO. has filed as part of its previously announced over-all recapitalization plan, a registration statement covering 11,972 shares of $100 par value cumulative preferred stock, the dividend rate to be supplied by amendment. The stock is to be offered in exchange for an equal number of shares of outstanding $6 cumulative preferred. Any shares not absorbed by the exchange offer will be publicly offered and the proceeds employed to redeem the remaining outstanding shares of $6 stock.

NEW ENGLAND PUBLIC SERVICE CO. was cited before the commission when the State Street Investment Corp., Boston, a management type trust, petitioned SEC to order the company to integrate its public utility system before proceeding with its reorganization. State Street, beneficial owner of 5,000 prior lien preferred shares of New England, asked the commission to "exercise its powers to examine the character of the interests and operation" of New England and its subsidiaries and "to determine the extent to which the businesses, properties and operations thereof are not confined to those necessary or appropriate to the operations of a single integrated public holding company system." State Street also asked the commission to protect its interests and those of other New England stockholders by ordering the divestment of New England's interests in holdings found not to be part of a single integrated system, "either by sale of the securities representing their interests . . . or by effecting a sale of the physical assets.

Hearing Scheduled

JANUARY 10: Reconvened hearings on American Light & Traction Co.'s amended application to its plan of liquidation will begin.

•

Stoneman Kept on Job

Directors of Dairyland Power Cooperative at La Crosse, Wis., recently unanimously refused the resignation of President E. J. Stoneman, who also is President of the National Rural Electric Cooperative Association. Stoneman resigned voluntarily following the reading of a resolution submitted by Clark Electric Cooperative of Wisconsin which called for the board of directors to request the resignation of Stoneman for reasons not made public.

•

Wisconsin Utility Men Ask WLB About Pay Increase

Recently placed before the Regional War Labor Board were questions of whether the 2,400 employees of the Wisconsin Electric Power Co., Milwaukee, 300 of the Wisconsin-Michigan Power Co., Appleton, and 700 of the Wisconsin Gas & Electric Co., Racine, have received all of the wartime wage increases to which they are entitled and whether the utilities may pay them a 6 percent "bonus" at the end of 1944 instead of holding it in trust until the end of government wage regulations.

The questions are new ones submitted by the utilities and employee unions after the Regional and National War Labor Boards ruled out use of a deferred-payment plan which would have placed 6 percent of 1944 wages in trust for employees until the Little Steel formula is revised upward or abolished.

•

Energy Requirements Dip, Peak Demands Advance

Electric energy requirements for October, 1944, indicate a total of 18,753,709,000 kw.-hr., up approximately 520,000,000 kw.-hr. from September, and a decrease of 1.3 percent from October of last year, according to preliminary figures released by the Federal Power Commission.

Preliminary figures on peak demands of the principal electric utility systems of the country for October, 1944, aggregated 36,020,424 kw., a decrease of approximately 318,000 kw. from the preceding month and a gain of 0.9 percent over October, 1943.

The latest available totals of Class I system estimates of the year's energy requirements and December peak demands for 1944 are 225,650,033,000 kw.-hr. and 37,957,793 kw.

UTILITY REPORTS

	Net Income 1944	1943
*Connecticut Light & Power	$3,063,093	$2,984,118
*Consolidated Gas Elec. Lt. & Power (Balto.) and subs	6,431,042	6,282,697
*Detroit Edison and subs	7,304,237	8,547,958
*Houston Lighting & Power	2,939,714	3,114,702
*Iowa Public Service	685,084	672,127
*Sioux City Gas & Electric	629,712	710,396
†Southern Colorado Power	360,445	328,769

*Twelve months ended November 30.
†Twelve months ended October 31.

How

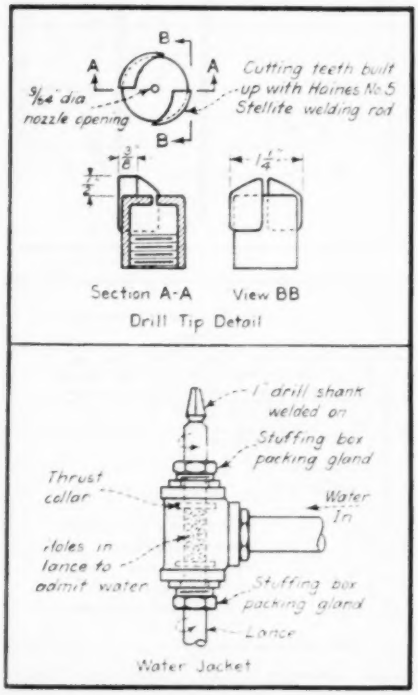
DESIGN · CONSTRUCT · OPERATE · MAINTAIN

Use Special Truck for Grounding Work

By H. E. REEVE
Supt. Transmission & Distribution
Iowa Power & Light Co., Des Moines, Iowa

A "grounding truck" equipped and devoted almost exclusively to the installation of grounds and ground rods at substations, transmission towers and along urban and rural distribution lines is a valued piece of mechanized construction equipment of the Iowa Power & Light Co.'s transmission and distribution department.

The truck's equipment, while neither elaborate nor expensive is complete and adequate to install semi-deep grounds at any point on the system regardless of location or convenience.



DETAILS OF DRILL tip and water jacket for water lance used in setting deep ground rods

Principal tool for this purpose is a water lance (see also ELECTRICAL WORLD, July 10, 1943 pages 78, 79) for sinking 8 or 10-ft. ground rods 28 to 30 ft. below the surface. Essentially the lance is a 20-ft. length of $\frac{3}{4}$-in. triple-strength steel pipe with a drill point and water nozzle at its lower end and which is turned into the soil by a 1-in. electric breast drill while water at 50 psi. is pumped into the top of the lance through a flexible water jacket. The electric drill chuck is clamped to a 1-in. drill shank welded to the top of the lance.

A 20-ft. hole is drilled with the lance which is then removed to allow a $\frac{3}{4}$-in. ground rod, with lead brazed to it, to be dropped to the bottom and tamped in with a "plugged pipe" tamp which slips over the first 2 or 3 ft. of the rod. Resistance of grounds installed in this manner averages around 5 ohms.

Basically the lance used by Iowa Power & Light is no different from others previously described. There are some notable departures, however, in details of power supply for drill and water pump operation, drill point design and the flexible "jacket" arrangement for introducing water into the lance while it is turning.

Where other water lance equipments have been confined to their operations to areas where 115-volts a.c. is available either from secondaries or customer's premises, this truck carried its own 115-volt a.c. power plant. Thus drill and water pump operation is assured at remote transmission towers as well as in town.

SPECIAL GROUNDING TRUCK equipped with gasoline engine generator, pump and water tank is used for installing deep grounds by the water lance method. Operator is shown starting engine generator with rope

The power plant is a commercially-available 1-kw. portable gasoline engine set designed for farm use.

The pump, that supplies water to the lance, was formerly part of an old transformer-oil filter-press. It is belt-driven from a 1/3-hp. single-phase motor and develops a working pressure of 50 psi. Should the lance become plugged, however, pressure of about 100 psi. is developed to clear the obstruction.

After considerable experimentation a reasonably durable drill point (see sketch) was machined in the shop from tool steel, in the form of a hollow cylinder with one end closed except for a 9/64 in. diam. water nozzle in the center. The cylinder has inside right hand threads for fastening to

the end of the lance. Teeth on the drill are built up in the shape indicated using Haines No. 5 stellite welding rod of the type used to impart a hard surface to bulldozer blades and power shovel teeth.

The water jacket, through which water passes into the revolving lance shaft, consists of a conventional pipe tee fitted with stuffing box glands at its upper and lower ends. The portion of the lance within the jacket is drilled with a number of holes to admit water to the lance core. Thrust collars welded to the lance inside the water jacket keep it in place.

To carry the water used in a day's operations a 600-gal. tank has been mounted on the grounded truck, which also carries the usual complement of shovels, digging bars, etc., that would be required in the course of grounding operations.

•

Maintenance of Ground Connections

A recommended procedure for annual check-up of lightning rod and arrester grounds is outlined by Associated Factory Mutual Fire Insurance Companies, Boston, in an Inspection Department Bulletin 15.66, as follows:

"Properly installed and grounded lightning arresters are the first line of defense in protecting important electrical equipment such as generators, switchboards and transformers from lightning damage. Similarly, factory stacks are less subject to damage if protected by lightning rods and conductors that permit the stroke to pass harmlessly to earth.

"In spite of apparently good lightning rod or arrester protection, lightning frequently will cause severe damage if high ground resistance hampers its dissipation in the earth.

'Experience has shown that ground resistance does not remain constant and that tests should be made at least once a year, and high ground resistance corrected.

"It is suggested that plants not equipped to conduct their own ground resistance tests contact their local utility company who generally have the necessary equipment and are experienced in making the tests.

"This work involves certain dangers. It is important that it be done by someone thoroughly familiar with the circuits to avoid connecting to a live conductor instead of to a ground conductor."

If resistance of lightning rod and arrester grounds exceeds 5 ohms, according to the Bulletin, it should be reduced by connecting to underground water pipes or by other methods; for latter see ELECTRICAL WORLD, December 23, 1944, page 113.

Three test methods for determining resistance of grounds will be outlined in another issue, as a guide for plants having the necessary equipment and experienced men to do this kind of work.

Method of Cuttingover 2,300 Δ to 4,000 Y—III

3. Steps in Cut-over

By J. J. BURRI
Supt. of Distribution
Staten Island Edison Corp., Staten Island, N. Y.

With the circuits now readily adaptable to the 4,000-volt wye system (changed over from 2,300-volt delta as described in ELECTRICAL WORLD, December 9, 1944 and December 23, 1944) all the circuits originating in one substation are put on the "A" bus which is connected to a temporary transformer bank in the substation yard. This permits the station bank to be taken out of service to be reconnected wye and then reenergized to supply the "B" bus at 4,000 volts. The foregoing work was done by the substation crews who reported on the job about six hours previous to the time set for the cutover of the circuits. This set up permitted a very quick method of cutting a circuit over with an interruption of only two to four minutes.

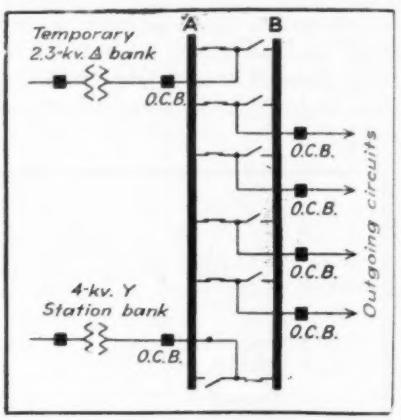
The actual steps to cut a circuit over were:

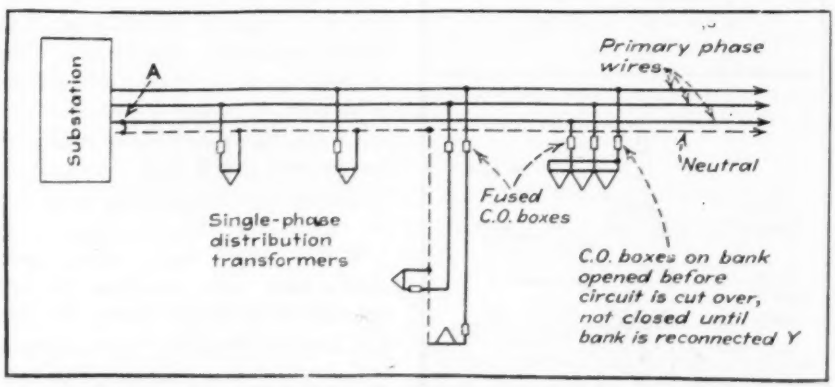
1. Open truck oil circuit breaker and "A" bus truck disconnect switches.

2. Remove jumper located near the substation between the phase and neutral wires. (In some instances additional jumpers were installed along the line of heavily loaded circuits and these jumpers were removed just prior to the actual circuit cutover).

3. Close "B" bus truck disconnect switches and then truck oil circuit breaker to energize circuit at 4,000 volts.

In reconnecting three-phase power banks on the line and in vaults arrangements were made with all power consumers as to the date and time for an interruption. A schedule was made and men were assigned to pull




Substation
A
Primary phase wires
Neutral
Fused C.O. boxes
Single-phase distribution transformers
C.O. boxes on bank opened before circuit is cut over, not closed until bank is reconnected Y

ARRANGEMENT OF SUBSTATION BUS (top) showing 2.3-kv. temporary transformer bank and the 4-kv. station bank. Typical circuit sketch (bottom) showing neutral and phase wires tied together at A. Loads are shifted to the neutral and other two-phase wire previous to being cut over to 4 kv.

the primary cutout plugs of various power banks and under ground services at given times. After all banks and underground services had been reported clear of the line the circuit changeover was made. The various banks on the line and in vaults were then reconnected wye and checked for motor rotation by the line and substation crews. The period of the interruption of power banks varied from 12 minutes to several hours according to the requirements of the consumer. The meter department men worked in conjunction with the line and substation crews in the reconnection of metering equipment on the primary lines.

Due to the careful planning and the methods used, the general public was not aware of this change in the system voltage. This was due to the fact that the individual circuits were cut over between five and six o'clock in the morning and the interruption to the service lasted only from two to four minutes.

•

Oils and Lubrication of Steam Turbines—VIII*

Procedure of Reconditioning—Oil Filtration

By J. A. TRISKA
Technical and Research Division
The Texas Co., New York City

Oil filters improve the stability of a turbine oil in service by removing undissolved contaminants, moisture, insoluble oxidized material, mineral matter, dirt, and in some cases, oil-soluble oxidized material. They are best adapted to force-feed lubricating systems.

The various types of oil filters with their limitations are:

1. Filters of the metallic or mechanical type involving edge filtration, copper ribbons, steel wool, screens or strainers, remove coarse contaminants such as metal chips and particles of grit and scale. Insoluble oxidized material is generally not removed unless the size of the particles is sufficiently large to be caught by the filter element openings. Nor can soluble oxidized material, finely divided carbon particles, water, dust, and the finer insoluble oxidized materials be removed by such filters.

2. Filters of the bag type, or filters composed of absorbent material, not only remove coarse contaminants but go a step further by removing more of the finely divided insoluble oxidized material. Certain of these filter materials also remove mineral acids as well as water. Filtration is accomplished by adhesion of contaminants to the surfaces of the filtering material.

3. Absorbent type filters contain fuller's earth bone-black, charcoal, or some active type of clay. In addition to removing coarse and fine contaminants, filters of this type remove to some extent soluble oxidized material and water. In such filters, oil contaminants do not adhere to the surfaces of the filtering material, but also actually penetrate. This may be a disadvantage when dealing with an oil containing a chemical additive, such as an inhibited turbine oil, for the filtering material may remove the oxidation or corrosion-retarding additive. Obviously an adsorbent type filter should, therefore, be carefully studied before it is applied to a turbine lubricating system.

*This series began September 30, page 93; in the ELECTRICAL WORLD.

• • •

Safety Climber Prevents Falls

Accompanying pictures show a "lineman's safety climber" which has been developed by J. C. Cox, lineman of Northern States Power Co., Robbinsdale, Minn. to prevent accidents caused by linemen falling from poles when fatigued or slipping from some other cause while climbing.

HAND HOLDS on the climber gives lineman's body a greater angle from pole that is more comfortable and less tiring for long climbs

Essentially the safety climber consists of a heavy iron wire overlaid with rope. It is semi-circular in shape with a hand hold at each end which gives the lineman's body, when climbing, a better position, or a greater angle with the pole that is more comfortable because the climber does not need to encircle the pole with his arms. Either one or two ropes, with snaps attached, are fastened near the climbing handles; these cross at the device and snap in the D rings of the body belt. Thus, if the climber's spurs should "cut out" or if he should slip in any manner, the pole is encircled by the device and holds the man securely suspended.

The tool would not appear suitable for use where poles are stepped or, in instances where poles are small and easy to climb. Its greatest value is seen to lie in transmission line work, for climbing high poles, poles of large diameter, ice-covered poles or those with attachment that linemen are forced to climb over when going up. It has been suggested that it could also be used to advantage when working from lineman's platforms or

LINEMAN'S SAFETY CLIMBER, designed to prevent falls when climbing high poles, poles of large diameter, ice-covered poles or any climbing that may cause fatigue

any location where a safety extension is required.

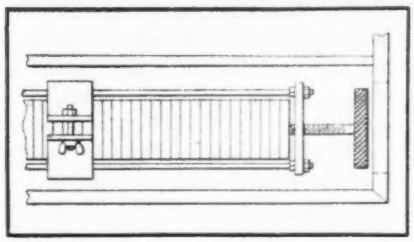
While to date the use of the safety climber has been restricted to Northern States Power Co., men who have used it recommend it highly.

•

"Turtle Head" Rheostat Handle

Protruding parts of devices contained in portable testing assemblies are a nuisance. They get knocked out of line or broken off and are unsightly. Which is why the carbon pile rheostat included in a boxed testing outfit used by the electrical laboratory and test division of the Tennessee Valley Authority was installed as shown in the accompanying sketch.

The equipment is packed tightly into the open-topped box and the room left for the rheostat is just enough to contain it, no space for a hand to get in to turn the tightening screw. It



CARBON PILE RHEOSTAT in testing assembly is movable to protect screw handle being knocked or broken

seemed that the only thing to do was to put the screw handle outside the box. Then the bright idea came.

The rheostat is held in a clamp, tightened with a wing nut. A round hole was cut in the side of the box in line with the screw handle. When the rheostat is to be used, it is slid along in the loosened clamp to put the handle outside the box. The work finished, the rheostat is slid back and the handle is safe from knocks.

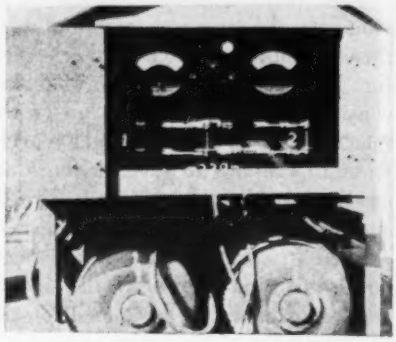
•

Arc Welding Machines Supply Auxiliary Power

By converting two arc welding machines to power generators, apparatus was made available for testing purposes and for supplying auxiliary power to Army cargo boats at the fitting out dock of the J. H. Mathis Shipbuilding Corp. The boats required 230 volts, 3-wire, d.c. service for power and lighting. A 40-kw. generator was needed since the largest equipment to be tested was 50 hp. at 230 volts.

As the company was unable to obtain a motor-generator set in less than six months delivery, Harry Baylie, chief electrician, experimented with 300-amp. arc welders connected for constant potential. He found that the Hobart Brothers Co. welders had good regulation and that the output voltage could be 115 volts without a very costly changeover. This change was made by substituting an additional shunt winding in place of a part of the series field coils and making these extra shunt coils self-exciting.

Each generator has a separate switch; consequently the outfit can supply 115 volts or be connected in series for 230 volts, with a midtap at 115 volts. Combined capacity of the generators should not exceed 30 kw. but no trouble was experienced with the machines operating at considerable overload for limited periods of time. Two power units have been built. Power facilities on the piers and ways terminate in panels with receptacles which are fused up to 100 amp., thereby making it convenient to move either unit from boat to boat.



POWER UNIT of two converted arc welders provides 230-volt, 3-wire, d.c. for testing and auxiliary purposes

The work for the changeover was done at a saving of approximately $1,000 plus not having to wait six months for shipment of power generators. Reconversion of the units to welding service can be done at any time within a few hours.

• • •

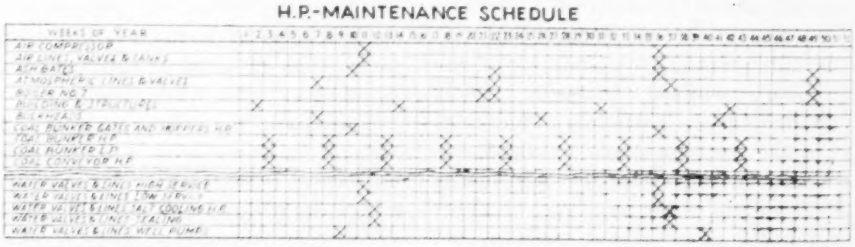
Schedule Balances Crew's Work Year

By CHARLES KIEL
Supt. of Generating Plant
Queens Borough Gas & Electric Co., Far Rockaway, N. Y.

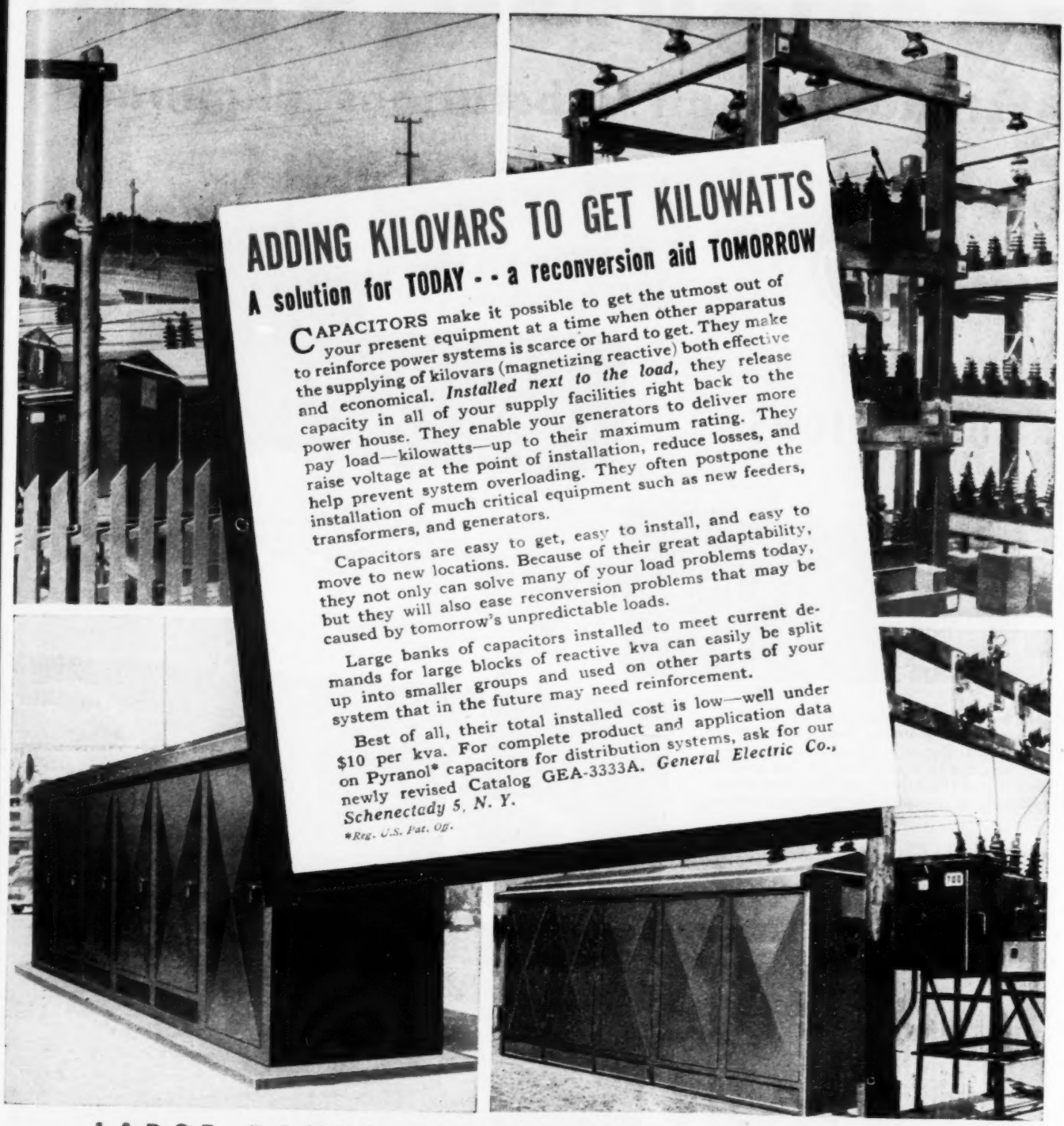
A high pressure steam maintenance schedule which is made up each fall by this company for an ensuing year makes it possible to arrange an evenly balanced work load for maintenance forces throughout the year. It certainly has been instrumental in eliminating the confusion, after hours and Sunday overtime that had previously been experienced at occasional times of major overhauls.

The schedule is made up after consultation between the company's steam and electric departments in full light of interconnections as well as local power requirements. It is posted on the bulletin board as a constant reminder of "what" work is to be done and "when". In this way both departments can dovetail their maintenance work and thereby have the least amount of equipment out of production service for the shortest feasible time.

The schedule which is a 11 x 18-inch form is shown in part. Following is a listing of the equipment, in parenthesis is indicated the number of times per year it is scheduled for inspection and repair. These are so spaced throughout the year as to keep the crews engaged at full working ca-



PORTION OF HIGH PRESSURE steam maintenance schedule showing manner of spreading work throughout the year and avoiding congestion



ADDING KILOVARS TO GET KILOWATTS

A solution for TODAY - - a reconversion aid TOMORROW

CAPACITORS make it possible to get the utmost out of your present equipment at a time when other apparatus to reinforce power systems is scarce or hard to get. They make the supplying of kilovars (magnetizing reactive) both effective and economical. *Installed next to the load*, they release capacity in all of your supply facilities right back to the power house. They enable your generators to deliver more pay load—kilowatts—up to their maximum rating. They raise voltage at the point of installation, reduce losses, and help prevent system overloading. They often postpone the installation of much critical equipment such as new feeders, transformers, and generators.

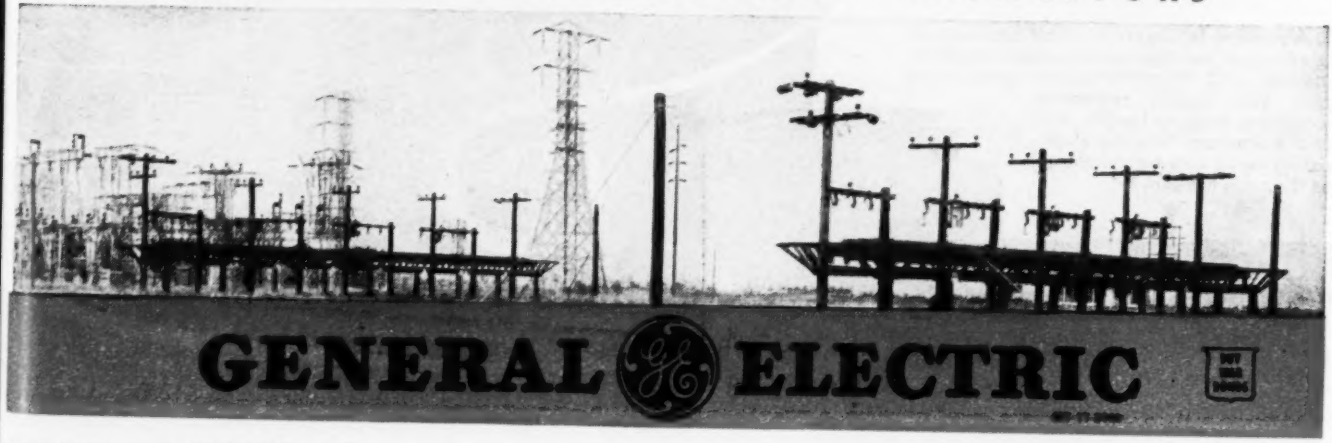
Capacitors are easy to get, easy to install, and easy to move to new locations. Because of their great adaptability, they not only can solve many of your load problems today, but they will also ease reconversion problems that may be caused by tomorrow's unpredictable loads.

Large banks of capacitors installed to meet current demands for large blocks of reactive kva can easily be split up into smaller groups and used on other parts of your system that in the future may need reinforcement.

Best of all, their total installed cost is low—well under $10 per kva. For complete product and application data on Pyranol* capacitors for distribution systems, ask for our newly revised Catalog GEA-3333A. *General Electric Co., Schenectady 5, N. Y.*

*Reg. U.S. Pat. Off.

LARGE BANKS OF PYRANOL CAPACITORS



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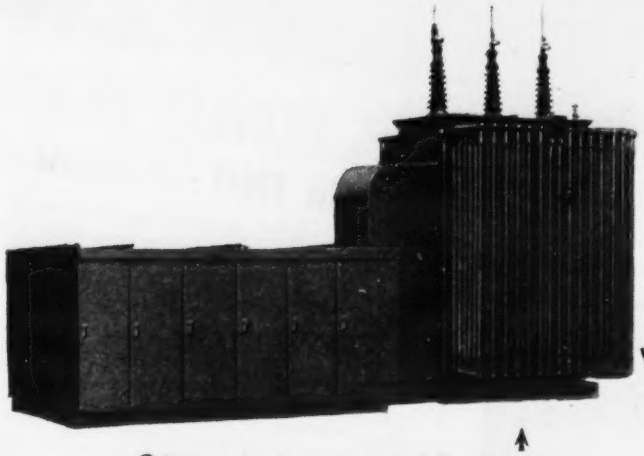
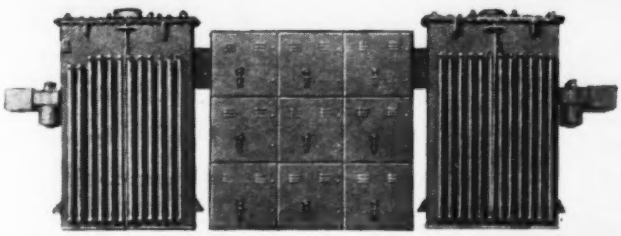
standard unit substations eliminate

GE

UNIT SUBSTATIONS



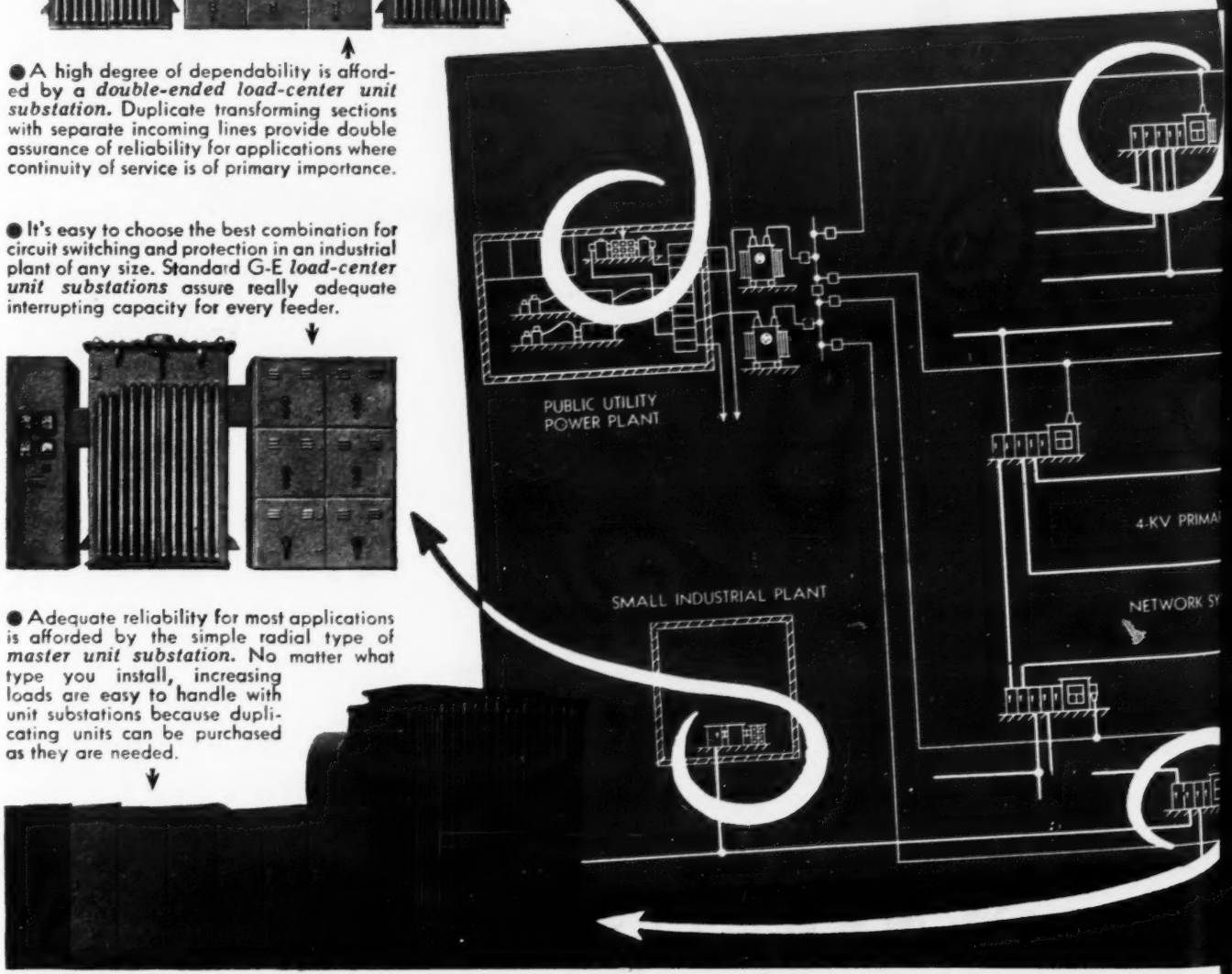
● Shifting loads are easy to follow because these completely enclosed, compact ***master unit substations*** are relatively easy to move. You avoid the confusion of lost or mislaid parts. Salvage value is 100 per cent.



● A high degree of dependability is afforded by a ***double-ended load-center unit substation.*** Duplicate transforming sections with separate incoming lines provide double assurance of reliability for applications where continuity of service is of primary importance.

● It's easy to choose the best combination for circuit switching and protection in an industrial plant of any size. Standard G-E ***load-center unit substations*** assure really adequate interrupting capacity for every feeder.

● Adequate reliability for most applications is afforded by the simple radial type of ***master unit substation.*** No matter what type you install, increasing loads are easy to handle with unit substations because duplicating units can be purchased as they are needed.

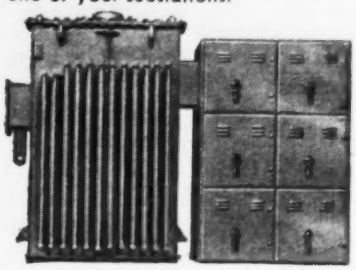


PLANNING LOAD

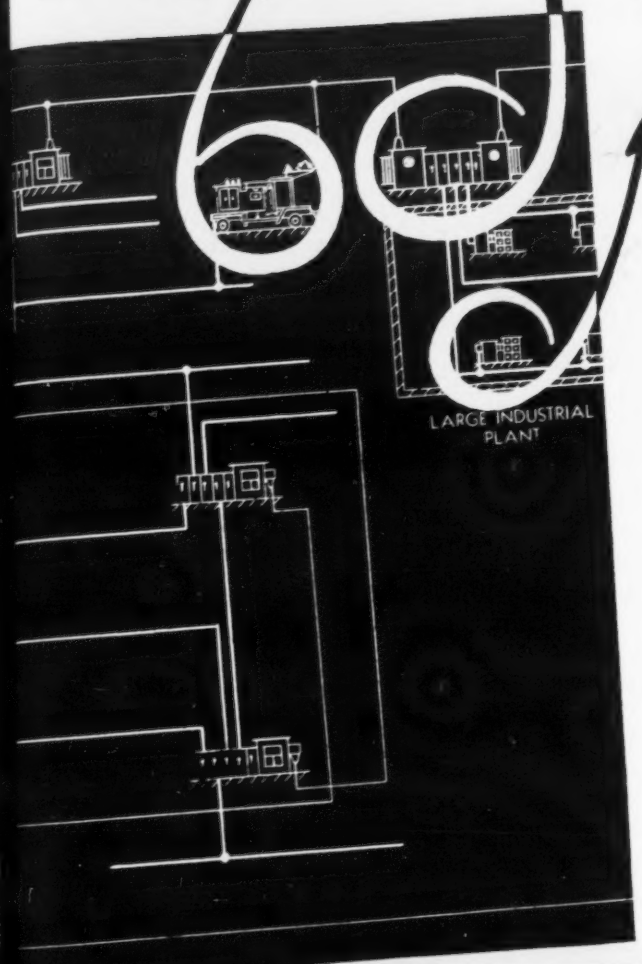
many worries about equipment details

● G-E *master unit substations* are shipped directly to the installation site in completely assembled sections. Installation is always much faster and easier; the installed cost is predictable, and is usually much lower than that of a piecemeal substation.

● Prevention of long-period outages at any point on your system is easy when you have a *mobile unit substation* which has enough capacity to substitute, during an emergency, for any one of your substations.



● Whatever the application may be, there is a repetitively manufactured, standard G-E unit substation which usually can fill the requirements at a saving in cost, compared with the cost of the "special" you may have in mind.



MANY operating companies have found that, by deciding early to use factory-assembled unit substations, they would have more time to study the over-all aspects of their system. This enables them to plan the changes necessary to insure better over-all system operation.

Why you don't have to worry about substation details

Standard G-E unit substations can meet almost any set of requirements. Like building blocks, unit-substation parts can be assembled in hundreds of standard arrangements, each of which is determined by the application and the system requirements. This flexibility of using the standard parts in many different combinations is the reason why unit substations can meet practically any application you may have; why you can feel free to plan over-all system improvements rather than devoting so much time to relatively unimportant details.

A well-planned system, one which has automatic, standard unit substations, means fewer customer outages, better voltage conditions, and a lower equipment-failure rate. The dispersal provided by a number of smaller units (see diagram), compared with one large, central substation, localizes trouble and prevents huge equipment losses as well as large-area outages.

Ask your G-E representative for Bulletin GEA-3800, or for a detailed presentation of our complete line in the light of your specific problem. *General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

pacity at all times without congestion at any time.

Air compressor (2), air lines, valves and tanks (2), ash gates (4), atmospheric lines and valves (4), boiler No. 7 (3), buildings & structures (4), bulkheads (3).

Coal Equipment

Coal bunker gates & hoppers H P (2), coal bunker H P (9), coal bunker L P (9), coal conveyor H P (9), coal conveyor L P (9), coal elevator inclined (9), coal elevator vertical (9), coal exhauster No. 1 & piping (2), coal exhauster No. 2 & piping (2), coal exhauster No. 3 & Piping (2), coal feeder No. 1 (4), coal feeder No. 2 (4), coal feeder No. 3 (4), coal feeder crusher house (6), coal feed piping H P (2), coal pulverizer No. 1 & piping (4), coal pulverizer No. 2 & piping (4), coal pulverizer No. 3 & piping (4), coal hopper (2), coal scale No. 1 (4), coal scale No. 2 (4), coal scale No. 3 (4), coal scale hoppers H P (3), coal storage (10), coal structure (2), coal transporter (3), condenser No. 3 (6), condensate lines & valves (2).

Controls

Control Dean (4), control hotwell level (2), control Smoot (2), cooler air generator No. 3 (4), cooler oil No. 1 (4), cooler oil No. 2 (4), ducts air (2), dust collector cyclones (2), dust collector cyclone tailpipes (2), dust collector dampers (2), dust collector ducts (2), dust collector 42 element (2), dust collector 60 element (2), dust collector 15 H P fan (2), dust collector 25 H P fan (2), dust collector insulation (2), dust collector tank (2), dust collector unloader (2), ejector air lines & valves (1), evaporator (2), evaporator condensate lines valves & trap (2), evaporator steam lines & valves (2), fan dampers I.D. & F.D. hands & Smoot (2), fan forced H P (4), fan induced H P (2), feed lines & valves (4), fire equipment (2), flues & dampers in same H P (4).

Heaters

Heater, evaporator condenser, piping & trap (2), heater, open evaporator & piping (2), heater, gland, piping & trap (2), heater, eleventh stage, piping & trap (2), heater, seventh stage & piping (2), heater, third stage piping (2), heating system—garage (1), heating system—plant building (1), hoist crane No. 3 unit (1), hoist, electric—fan room (1), hoist gasoline—Brown (2), instruments (6), preheater hoppers (2), preheater No. 7 boiler (2), preheater piping (2), property (4).

Pumps

Pump boiler feed No. 7 (2), pump boiler feed No. 2 (2), pump chemical (1), pump circulating water No. 7 (4), pump circulating water No. 2 (4), pump condensate No. 1 (2), pump condensate No. 2 (2), pump condensate to seventh stage heater, pump dewatering (1), pump eductor (1), pump ejector air (1), pump eleventh stage drainer (2), pump evaporator feed (2), pump floor trench (2), pump low service (1), pump I D fan water No. 1 (2), pump I D fan water No. 2 (2), pump LeBlanc air (4), pump oil No. 1 (1), pump oil No. 2 (1), pump sluice (2), pump Smoot (2), pump vacuum system (3), pump well No. 1 (1), pump well No. 2 (1), pump well No. 3 deep (4), screens No. 1 & No. 2 revolving (6), stack H P (2), steam lines aux. H P (2), steam lines main H P (2), steam lines saturated H P (2), sluicing, tunnel, nozzles & piping (3), strainer air cooler No. 3 unit (2), strainer LeBlanc air pump (2), strainer oil cooler No. 3 unit (2).

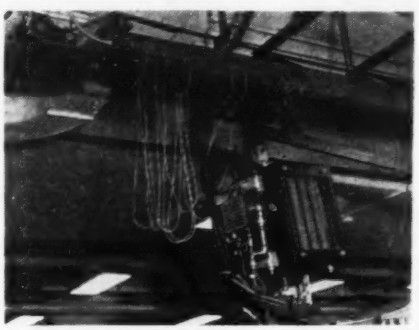
Tanks

Tank-chemical (1), tank-high water service (1), tank-low water service (1), tank-oil upper & lower & piping (1), tank-seal No. 3 unit (3), tank-surge No. 3 unit (1), tunnels & gates No. 3 unit (3), turbine house (2), turbine No. 3 (2), valves Chapman No. 1, No. 2 & dividing (2), wash rooms (2), water fountains (2), water valves & lines city service (2), water valves & lines fire (2), water valves & lines fresh cooling H P (2), water valves & lines high service (2), water valves & lines low service (2), water valves & lines salt cooling H P (2), water valves & lines sealing (2), water valves & lines well pumps (2).

Spot Welder Arranged for Portability

By the introduction of a portable spot welder to tack-weld parts together in an assembly fixture, production of B-26 bomb bay doors has been further simplified and accelerated at the plant of The Glenn L. Martin Co., Baltimore, Maryland. This is in addition to the already greatly speeded production through the use of spot welding in place of riveting. The new procedure cuts the number of operations in half and has reduced by more than 50 percent the time required to make the assembly.

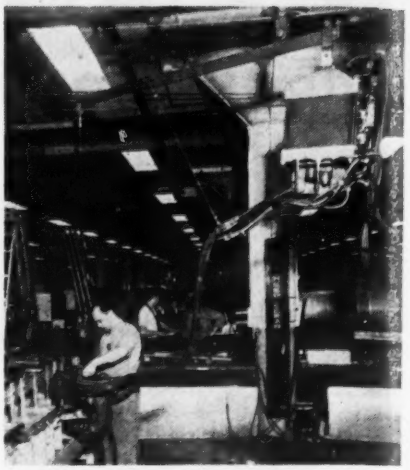
The portable spot welder consists of a spot weld machine and transformer counterbalanced on a small beam pivoting from an overhead trolley travelling along a 50-ft. I-beam. The trolley is driven by a sprocket and chain powered by a $\frac{1}{3}$-hp. motor. A 200-kva. machine with a welding capacity of two thicknesses of



SPOT WELDER counterbalanced on beam pivoting from trolley which is operated by motor through chain drive

0.040 aluminum is used, and the arrangement permits it to operate over a large floor area. Spacers are provided on the I-beam to support the drive chain when the apparatus moves from the end of the beam.

Under the new procedure the skin, frames and stiffeners for the doors are all cleaned for spot welding and assembled in a fixture. They are then tack welded together with the portable spot welder and the entire assembly is carried to a floor type spot welder for



PORTABLE SPOT WELDER used to tack-weld bomb bay door assemblies

completion of the welding.

Before the introduction of the portable spot welder, it was necessary to first assemble the parts in a drill fixture where holes were drilled for skin clamps; then disassemble, clean and burr them for spot welding; put them together, fasten them with the skin clamps and spot weld them; and finally remove the skin clamps and drive rivets in the holes from which they were taken.

•

Screw Anchor Rules

The New England Power System, Boston, Mass., has set up regulations restricting the use of screw anchors to locations having fine sand or swampy soils, where, due to flowing or caving in of the soil, proper excavation for cone or plank anchors cannot be made. Screw anchors are not allowed on the system where stones or tree roots are likely to be encountered. Anchors are required to be installed with the rod in line with the guy, and to the depth shown in the table. Any decrease in the depth decreases the maximum load approximately as the cube of the depth. The preferred slope of the guy is a length-to-height ratio of 1 to 1. While this may be larger on occasion, the regulation limits it to 1.5 to 1.

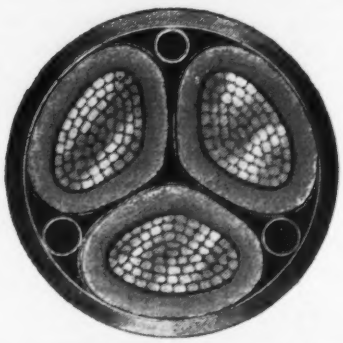
Screw Anchor Settings

New England Power System

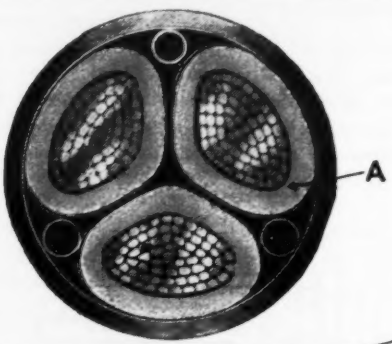
Approved Anchor	Anchor Diam.	Rod Diam.	Rod Length	Depth of Setting	Maximum Load Lb. Sand	Maximum Load Lb. Swamp
A	10 in.	1.25 in.	5.5 ft.	5 ft.	4,000	2,000
B	10 in.	1.25 in.	8 ft.	7.5 ft.	5,000	3,000

If loads greater than the above are to be carried, two or more anchors are specified for installation.

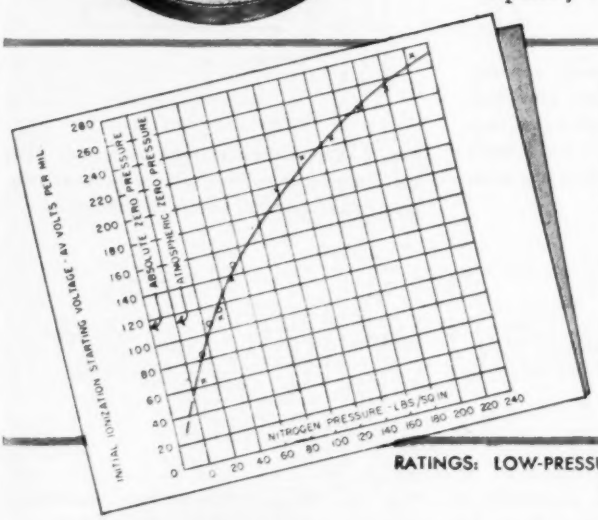
How "AUTOMATIC GRADING" adds to the strength of G-E mass-impregnated gas-filled cable



CONTROLLED GAS PRESSURE begins its contribution to this strong, self-protected cable right at the treating tank. After impregnation, drainage of surplus compound takes place in a regulated atmosphere of nitrogen gas, until a capillary balance is reached. Under these conditions, more compound is held in the inner zone near the conductor than in the outer zone. Significantly, as the red shading of the cross-section shows, this distribution of compound corresponds to the distribution of electrical stress outward from the conductor.



UNDER VOLTAGE STRESS, a further strengthening effect occurs. In G-E gas-filled cable, the impregnating compound is carefully selected to be sufficiently viscous to stay in place without bleeding freely, and yet be sufficiently mobile to be moved by electrostatic action. Voltage stress acts by electrostatic attraction to draw this mobile compound into the voids and butt spaces where the stress is greatest, rearranging the distribution of the compound in the cable cross-section so that all critical points of high stress (such as at sector edges A) are strengthened. The combined effect of capillary action and voltage stress is called *automatic grading*.



THE SAFE LIMITS of a cable's dielectric strength are indicated by persistence of ionization. In G-E gas-filled cable, however, incipient ionization is (1) *suppressed* by the controlled pressure (see chart), and (2) *self-extinguished* by automatic grading and by an effect known as "self-healing action" from "X-wax" formation.

The self-supervising feature, which warns of sheath damage, and this *self-protecting ability* help explain why we regard mass-impregnated gas-filled cable as tomorrow's universal cable-type, within its recommended voltage range. ***General Electric Company, Schenectady 5, N. Y.***

RATINGS: LOW-PRESSURE TYPE, 10 TO 40 KV; MEDIUM-PRESSURE TYPE, 40 TO 69 KV

GENERAL ELECTRIC

501-23-1200

PUSHBUTTON CONTROL CIRCUITS FOR L-V RELEASE AND L-V PROTECTION

By L. E. MARKLE, Control Engineer, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Two types of control circuits, commonly known as two- and three-wire control, require different types of pushbuttons. A control button either makes a circuit or breaks a circuit. Pushbutton stations are arranged so that either or both operations can be obtained on the same unit. Low-voltage (L-V) release requires a maintained-contact type pushbutton. Low-voltage protection is secured by a momentary-contact type pushbutton.

Low-voltage release provided on a control circuit allows all equipment to be disconnected from the line if for any reason the power source voltage is inadequate, but when the voltage again reaches sufficient value the control will function automatically to connect the apparatus to the line through the proper starting sequence. This type of control circuit requires a pushbutton having contacts that remain closed until released by hand.

Low-voltage protection on a control circuit allows all apparatus to be disconnected from the line if the power source fails or a disturbance occurs that causes the line voltage to drop to a very low value. In order to start the apparatus again, it is necessary to actuate the start button.

To obtain low-voltage protection, it is necessary to have a start button that closes the control circuit only when it is being held down. An electrical interlock that is closed when the control has functioned parallels the start button and keeps the control circuit closed after the start button is released. When the control drops out because of voltage failure, the interlock opens the control circuit, thus giving protection against unsupervised starts when power returns to the control and equipment.

Any combination of control sequence for low-voltage protection can be obtained by applying these two fundamental rules:

1. Start buttons, connect all in parallel with each other and with the electrical interlock.
2. Stop buttons, connect all in series with the holding coil, with each other, and with the electrical interlock.

Fig. 1 shows the diagram for a low-voltage release pushbutton connection; Fig. 2-10, are diagrams for low-voltage protection.

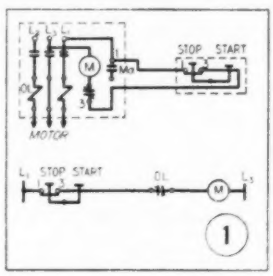


Fig. 1—Circuit: low-voltage release, single station. Duty: start-stop. Buttons: two maintained-contact

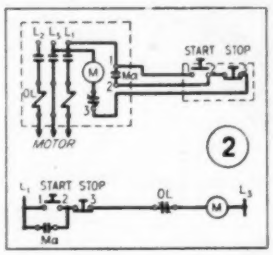


Fig. 2—Circuit: low-voltage protection, single station. Duty: start-stop. Buttons: two momentary-contact, one closed, one open

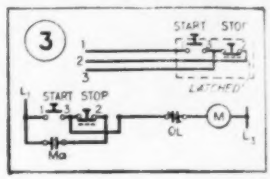


Fig. 3—Circuit: low-voltage protection, single stations. Duty: start-stop (latched for inching). Buttons: two momentary-contact, one open, one closed with safety latch

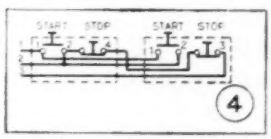


Fig. 4—Circuit: low-voltage protection, two station. Duty: start-stop start-stop. Buttons: four momentary-contact, two open, two closed, compare Fig. 5

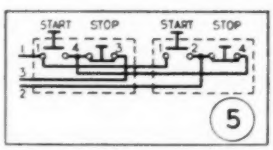


Fig. 5—Circuit: low-voltage protection, two stations. Duty: start-stop, start-stop. Buttons: four momentary-contact, two open, two closed, compare Fig. 4

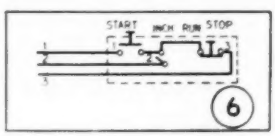


Fig. 6—Circuit: low-voltage protection plus inching. Duty: start-run, inch-stop. Buttons: two momentary-contact and one selector switch

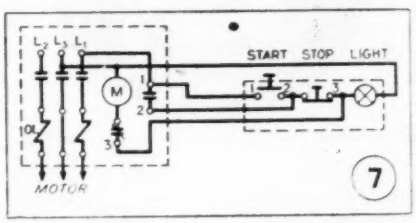


Fig. 7—Circuit: low-voltage protection, single station. Duty: start-stop. Buttons: two momentary-contact, one indicating light

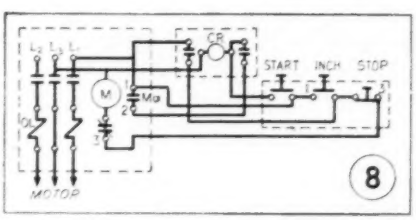


Fig. 8—Circuit: low-voltage protection plus foolproof inching. Duty: start-inch-stop. Buttons: three momentary-contact, two open, one closed, and inching relay

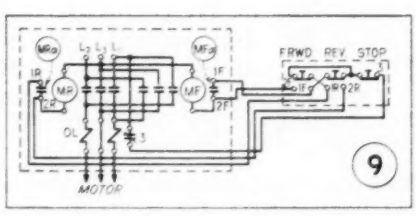


Fig. 9—Circuit: low-voltage protection, interlocked through pushbuttons. Duty: forward-reverse-stop. Buttons: three momentary-contact, two open, one closed

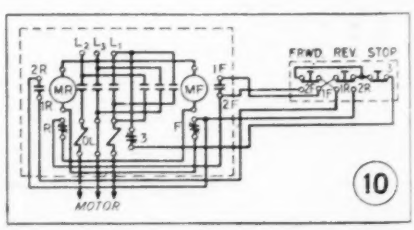


Fig. 10—Circuit: low-voltage protection with electrical interlocks. Duty: forward-reverse-stop. Buttons: three momentary-contact, two open, one closed

TYPE SN for General Purpose Wiring

TYPE SNW for Wiring in Wet Locations

Thermo-plastic Insulated Wire For Complete Wiring Systems

Flamenol BUILDING WIRE

(SMALL DIAMETER)

IDEAL FOR NEW WIRING

Now you can obtain Flamenol* small diameter thermo-plastic insulated building wire for entire wiring systems—Type SN for general purpose wiring; Type SNW for wiring in wet locations. Both types are available in sizes 14 to 2,000,000 CM. Type SN Flamenol wire was developed before the war and has proved its worth in hundreds of installations. Type SNW Flamenol wire has all the good qualities of Type SN. In addition, its insulation has a low moisture absorption rate.

IDEAL FOR RECONVERSION WIRING

Flamenol Building Wires are ideal for reconversion wiring and maintenance wiring as well as for new wiring. Their insulation is practically ageless, is high in dielectric and mechanical strength and is resistant to flame, oils, acids and alkalies. Both types are easy to strip, splice and pull. Their small diameters enable more conductors to be used in conduits or ducts. Color goes all through the insulation and is permanent.

For Further Information on Flamenol Building Wire, see the nearest G-E Merchandise Distributor or write to Section W152-9, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn., for descriptive folders.

* Reg. U.S. Pat. Off.

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news, every weekday 6:45 P.M. EWT, CBS.

BUY WAR BONDS AND HOLD THEM

ADEQUATE WIRING
WILL PLAY A VITAL PART
H. C. Rice, manager of domestic sales, Southern California Edison Company, says, "People who plan to build homes after the war are thinking in terms of modern electrical development. Adequate wiring will play a vital part in making electrical conveniences available in postwar homes."
ADEQUATE WIRING
THE KEY TO THE HOME OF TOMORROW
SERVES AND SAVES

GENERAL ELECTRIC

How to build Store

General Electric's NEST EGG Plan is Ready for Immediate Action!

More than 60 per cent of the merchants interviewed in a recent General Electric survey said they had been influenced to buy fluorescent lighting by installations in other stores.

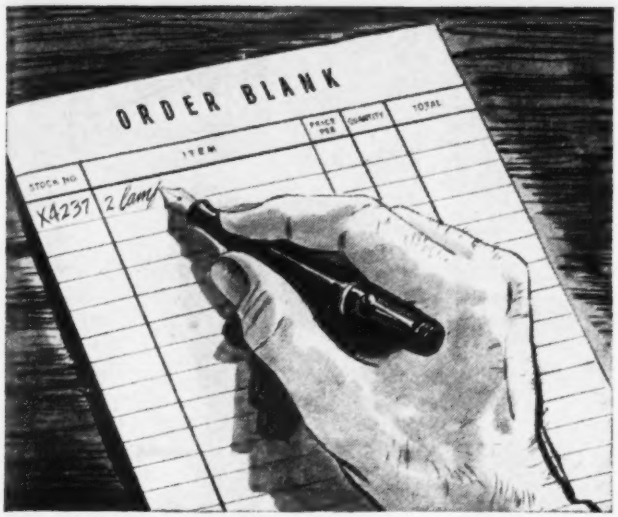
After the war, just as before, what the store owner sees in other stores will influence his own relighting plans. That fact is the basis of the General Electric "nest egg" plan. By selling one outstanding relighting job in each shopping area *now* you set the postwar standard for the whole neighborhood.

Store owners want new lighting and General Electric Lamp advertising in more than a score of trade publications reaching store owners, is telling them about better lighting. They want your advice—among those not using fluorescent now, more than two-thirds say they look to utilities for advice. Read how the G-E "nest egg" plan works.

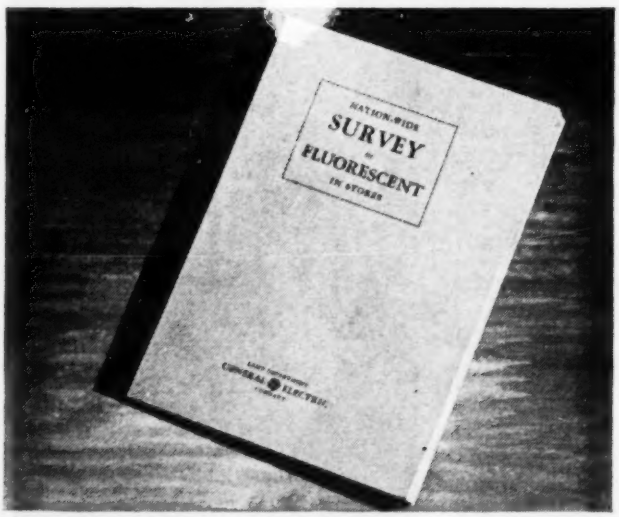
1 SELECT YOUR NEST EGGS. Find a good prospect for modernized lighting in each neighborhood in your territory . . . explain to the owner how better lighting will attract more customers and build sales . . . and show him how his can be one of the *first* stores in that neighborhood to be relighted.

3 GET THE NEST EGGS INSTALLED FIRST. With all this preliminary work done, you can see to it that these stores are among the first in their neighborhoods to be relighted . . . shining examples of good lighting . . . "nest eggs" that will make other stores in the same neighborhoods want good lighting jobs.

Lighting Sales NOW



2 ORDER THE MATERIALS NOW. Bring a contractor and supplier in on the job... make a layout for the store's general lighting, and showcase, display and decorative lighting, both incandescent and fluorescent. Place orders for the fixtures, lamps and all other materials NOW, for delivery as soon as available.



4 WHAT HAPPENED TO COMMERCIAL LOAD when fluorescent was installed? Would greater sales effort have sold more kilowatts? Will store owners buy more? Here are the results of a nation-wide survey made by utility and G-E lamp men—answers to many of your questions. Write Div. 166-EW-A6, Nela Park, for your free copy!

HERE'S WHAT ONE UTILITY HAS DONE ALREADY!

One of the leading utilities in the Southeast already has a "nest egg" plan in effect . . . a program for selling model installations that goes back before the war. They report that many additional installations were sold as a result of the influence of these "nest eggs." There were no subsidies in any form.

The company's "nest egg" plan calls for:

1. Relighting of all its own main offices and sales rooms.
2. Sale of at least one "nest egg" lighting job in each type of commercial establishment.
3. Sale of at least one "nest egg" job in each trading center throughout the territory. The company already has sold about one nest egg installation per 200 commercial meters.

Why not consider the G-E nest egg plan for your territory?

BUY WAR BONDS AND HOLD THEM

Hear the G-E radio programs: "The G-E All-Girl Orchestra", Sunday 10:00 p. m. EWT, NBC; "The World Today" news, Monday through Friday 6:45 p. m. EWT, CBS; "The G-E Houseparty," Monday through Friday 4:00 p. m. EWT, CBS.

G-E MAZDA LAMPS

GENERAL ELECTRIC

HOW TO TRANSFER A 13.2-KV. CIRCUIT FROM AN OLD POLE TO A NEW POLE

Successive steps in transferring high-tension conductors without interrupting the service and the use of live-line maintenance tools for that procedure are shown in the accompanying illustrations. The transfer was made by a line crew of the Iowa-Illinois Gas and Electric Co., Rock Island, Ill.

In order to insure safety to the men the old pole has been tied to the new pole in addition to being supported by pike poles, and the 4,800-volt distribution circuit below has been covered with rubber line hose and boots.

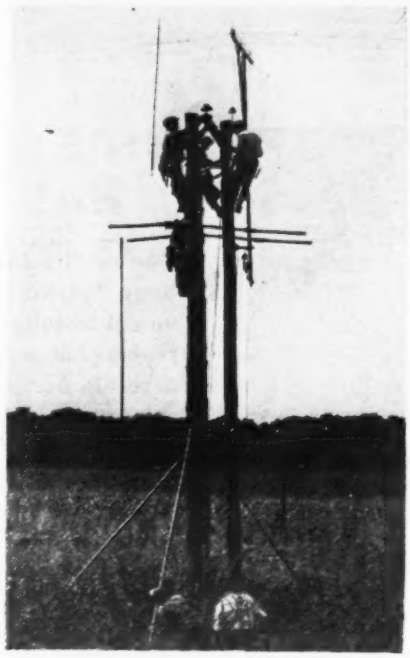


FIG. 1—Energized wires are raised several feet by a lifting arm and a new crossarm is attached to the new pole.

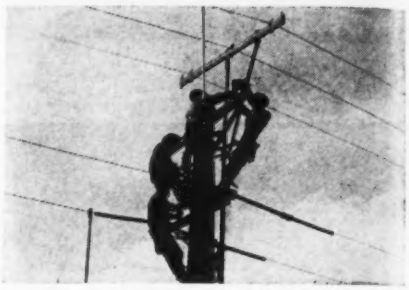


FIG. 2—New insulators with hot tie wires being put in place

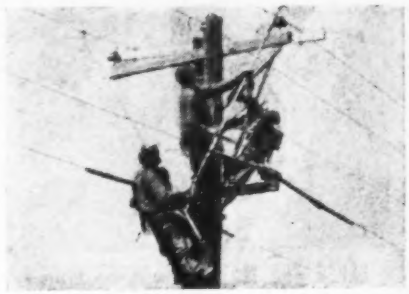


FIG. 3—Energized conductors are lowered by lifting arm and tied in

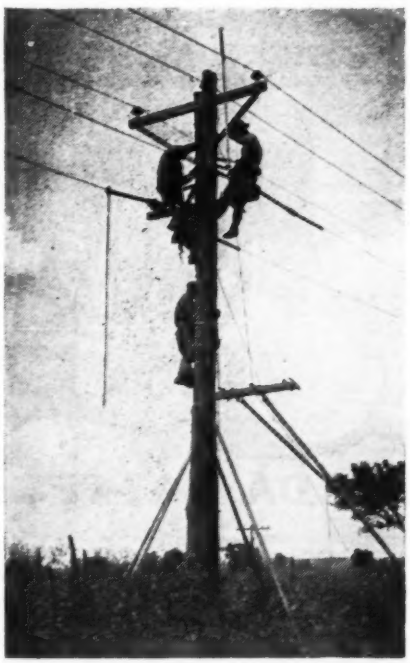


FIG. 4—Conductor transfer has been completed and the lifting arm is being lowered to the ground

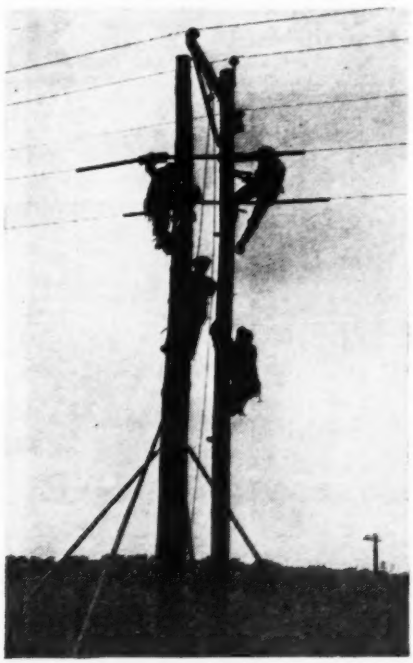


FIG. 5—All tools have been lowered; rope ties for poles have been removed, and men are preparing to leave

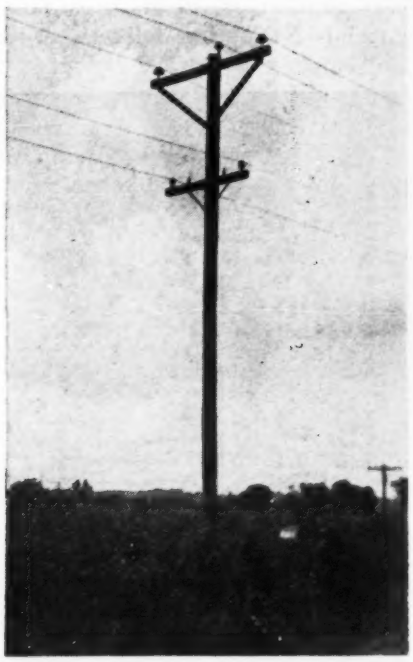
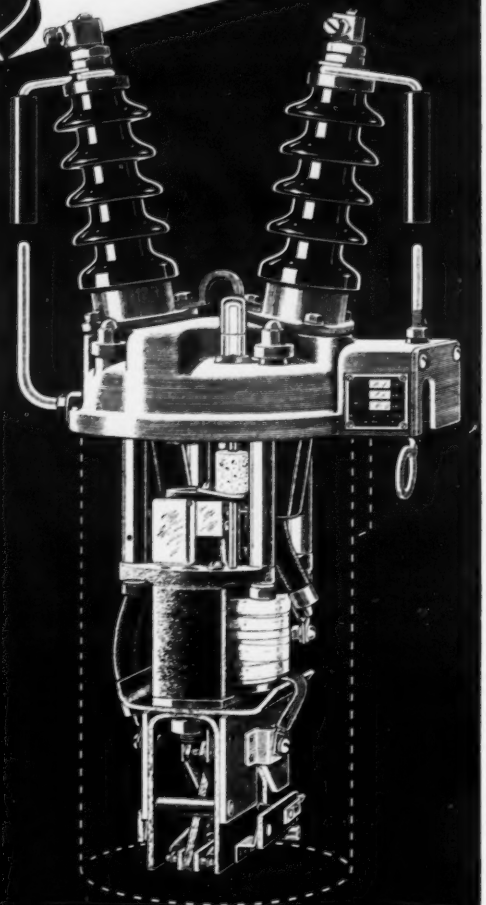


FIG. 6—Secondary crossarm was attached, old pole removed and the job finished with service uninterrupted

...THE TYPE "H" KYLE AUTOMATIC OIL CIRCUIT RECLOSER

OFFERS Dual time current characteristics . Dependable hydraulic timing . 5 Different coil ratings . Safety to the operator



CUT-A-WAY VIEW OF TYPE "H" KYLE OIL CIRCUIT RECLOSER

RATINGS: Volts—2400 to 15,000; Amperes—5 to 50; Tripping Current —10 to 100 Amperes; Interrupting Current—150 to 1200 Amperes.

The Type "H" Kyle Automatic Oil Circuit Recloser will keep your main lines open...increase your revenue...reduce your operating costs.

Check these Kyle features which assure the automatic clearing of all temporary faults and the isolation of feeder lines where permanent faults develop.

ELECTRICAL FEATURES

CHOICE OF OPERATING CHARACTERISTICS:

1. *Fast Opening* on first and second operations. *Time Delay* Opening on third and fourth.
2. Fast Opening on *all four* operations.
3. *Time Delay Opening* on *all four* operations.

DOUBLE, FAST ACTING CONTACTS:

1. Prevent burning of contact surfaces by high speed opening and closing.
2. Constructed of special arc-resistant alloys.
3. Self-cleaning and cannot chatter.

PROTECTIVE FEATURES:

1. Lightning protection is provided by spark gaps on both bushings which dissipate surges to the ground.
2. Thermal trip will lock out Recloser to prevent damage from high overloads over an extended period.

MECHANICAL FEATURES—Hydraulic Control Mechanism: Provides accurate timing on all operations . . . time delay opening of the Recloser when desired.

Coils are easily replaced by removing coil leads and two nuts. Contact assembly is replaced as a unit by removing two nuts and contact leads. Steel tank is of one piece design with no openings below oil level.

The Type "H" Kyle Recloser is compact in size . . . 27¼" overall height . . . 8" tank diameter. Light in weight . . . 65 pounds complete with oil. Inexpensive single bolt mounting.

A counter is provided to count each Recloser operation. An oil level gauge indicates the proper oil level.

SAFETY FEATURES—Operating handle is trip-free. Recloser may be manually closed without danger to operator. When the Recloser is in the open position, vibration or jar cannot cause it to fall closed accidentally.

Steel tank and cover are electrically dead. Provision is made for grounding them.

The only live parts are the upper terminals on the bushings, providing easy, safe access to the operating handle.

Ask your Line Material Representative for full information on the Type "H" Kyle Automatic Oil Circuit Recloser.

MADE BY KYLE CORPORATION SOUTH MILWAUKEE WISCONSIN

KYLE Circuit Breakers are Designed and Manufactured by LINE MATERIAL COMPANY MILWAUKEE WISCONSIN

HOW TO DETERMINE CLASS OF POLE REQUIRED

By PHILIP MORRILL, Windham, New Hampshire

Accompanying chart has been developed on the basis of pole classes. Classification of poles follows the rule that butts are larger for taller poles in a given class so that the load which may be applied to a point 2 ft. from the top of a pole is constant for that class of pole irrespective of the length of pole.

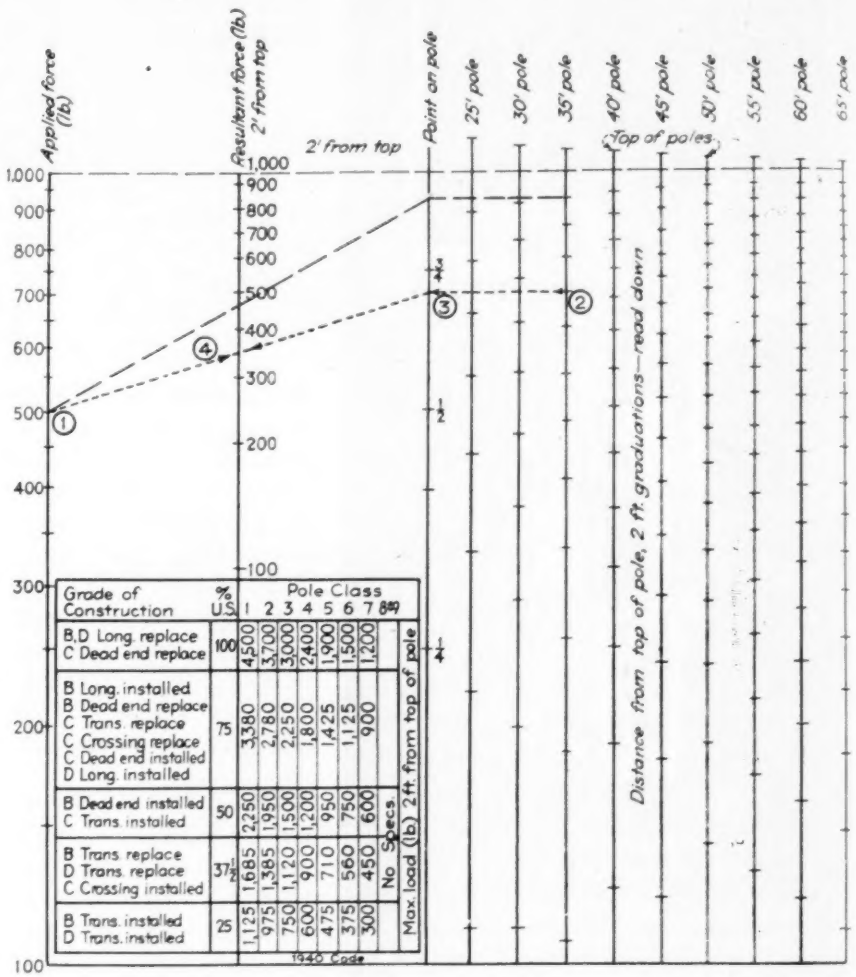
The chart is based on the assumption that poles are set to standard depths for normal soil. However, normal settings for rock or for corners will not change values sufficiently to affect practical results.

Loads may be determined from wire charts when the span, wire size, and sag, insulation and loading district are known. Tension of wire is the important factor in dead end stresses. From code requirements for clearances, the spacing of crossarms and the clearance from ground is determined, and these in turn regulate the pole length.

In using this chart, it is assumed that the pole length and point of application of crossarms and force on crossarms is known. These loads are then converted on the chart to an equivalent load, which if applied at a point 2 ft. from top of pole would give stress at the butt equal to the loads at the actual points of application. This equivalent load is then used on table in lower left hand corner of chart to choose class of pole for required grade of construction.

Abbreviations for the chart: Long. = longitudinal forces parallel to line. Trans. = transverse forces at right angles to line. % U.S. = percent ultimate strength.

Chart does not include windage on pole. This will vary from 40 to 100 lb. depending on length of pole and loading area. It may be ignored but estimate could be added if pole is close to border line between classes.


Applied force (lb)
Resultant force (lb) 2' from top
Point on pole
2' from top
25' pole
30' pole
35' pole
40' pole
45' pole
50' pole
55' pole
60' pole
65' pole
Top of poles
Distance from top of pole, 2 ft. graduations—read down
1,000
900
800
700
600
500
400
300
200
100
Grade of Construction
% U.S.
Pole Class 1 2 3 4 5 6 7 8 9
B,D Long. replace C Dead end replace 100 4500 3700 3000 2400 1900 1500 1200
B Long. installed B Dead end replace C Trans. replace C Crossing replace C Dead end installed D Long. installed 75 3380 2780 2250 1800 1425 1125 900
B Dead end installed C Trans. installed 50 2250 1950 1500 1200 950 750 600
B Trans. replace D Trans. replace C Crossing installed 37½ 1685 1385 1120 900 710 560 450 No Specs.
B Trans. installed D Trans. installed 25 1125 975 750 600 475 375 300
Max. load (lb) 2 ft. from top of pole
1940 Code

Example:

A 500-lb. load (1) is applied to a 35-ft. pole at a point (2) 10 ft. from top. (2) is carried horizontally to line at (3). A diagonal connecting (1) and (3) intersects load line at (4) and gives a reading of 340 lb. If Grade B construction is desired then the chart indicates a Class 6 pole to be installed.

If another crossarm with 500-lb. loading was added to above pole 4 ft. from top then the chart gives an equivalent load of 460 lb. The total equivalent load is 340 plus 460 or 800 lb. and table gives a Class 2 pole for Grade B construction.

SELECT G-E FUSES
For Your Wiring Jobs

Protect wiring systems and electrical equipment with G-E fuses. Specify them on maintenance jobs. These are the same fuses General Electric uses to protect its own wiring and equipment. They are made of the finest materials and are thoroughly tested and accurately rated.

G-E Non-renewable Enclosed Fuses 1–600 Amp., 250 V. or 600 V. Both indicating and non-indicating types are available.

G-E Renewable Enclosed Fuses 3–600 Amp., 250 V. or 600 V. Fiber bar supports link, provides proper alignment of terminals, facilitates replacement.

G-E Silvend Fuses with silver-plated contacts 3–600 Amp. 250 V. or 600 V. Designed for use with apparatus having silver-plated fuse contacts. Heating due to oxidation does not occur with this combination.

G-E Pyrex Plug Fuses 3–30 Amp., 125 V. Neat appearing. Have magnifying windows for easy reading.

You'll find G-E fuses of the correct type and proper rating to use for all purposes. They are all high quality and in keeping with the finest wiring.

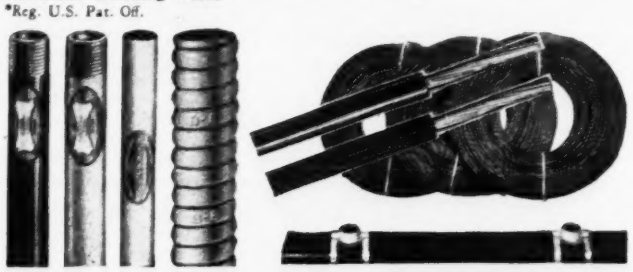
FOR FURTHER INFORMATION on G-E fuses or conduits or building wires see the nearest G-E Merchandise Distributor or write to Section CDW152-9, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

IMPORTANCE OF ADEQUATE WIRING
Victor W. Hartley, managing director of the Pacific Coast Electrical Association, Los Angeles, Calif., says, "Wiring is a 'hidden value.' Upon its adequacy depends, in a substantial degree, not only the quality of the structure, but its soundness as a long-term investment."
ADEQUATE WIRING
THE KEY TO THE HOME OF TOMORROW
SERVES AND SAVES

G-E CONDUIT AND BUILDING WIRES

There are five different conduits and many building wires in the G-E line including: G-E White and G-E Black rigid conduits, EMT, flexible conduit, Fiberduct and Types SN and SNW small diameter, thermo-plastic insulated Flamenol* Building Wire.

*Reg. U.S. Pat. Off.



Hear the General Electric radio programs: "The G-E All-Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news, every weekday 6:45 P.M. EWT, CBS.

BUY WAR BONDS AND HOLD THEM

GENERAL ELECTRIC

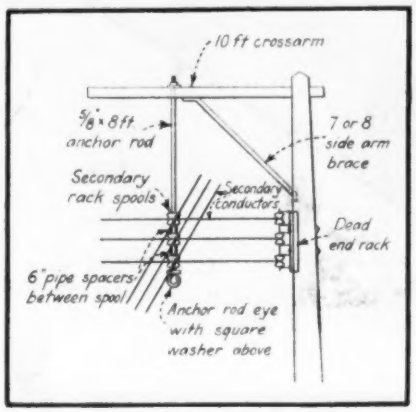
Suspend Secondaries From Outrigger Arm

By J. J. GRAVEN
Distribution Engineer
Central Illinois Electric & Gas Co., Rockford, Illinois

Shown in the accompanying illustration is method used to support secondary conductors in their original position at a street intersection in Rockford, Illinois, where street paving work made it necessary to relocate the original corner pole to make room for a larger curb radius.

Secondaries are supported from spools at the lower end of a ⅝-in. by 8-ft. anchor rod bolted at its upper end to a 10-ft. outrigger crossarm extending from the relocated pole.

Spacing of insulating spools on anchor rod is the same as that on a conventional secondary rack and was obtained by the use of pipe spacers. Spools were kept on the lower end of the rod by the anchor rod eye which has a square washer above it.


10 ft crossarm
⅝" x 8 ft anchor rod
7 or 8 side arm brace
Secondary rack spools
Secondary conductors
Dead end rack
6" pipe spacers between spool
Anchor rod eye with square washer above

RELOCATION of corner pole at street intersection led to this novel method of supporting secondary conductors in their original position. Principal parts required are: outrigger arm, anchor rod, three insulated spools with spacers

Welder-Born Flicker Can Be Reduced*

By C. N. CLARK
Distribution Engineer
Duquesne Light Co., Pittsburgh, Pa.

In the past decade many single-phase resistance welders ranging from a few kva. to 1,000 kva. have been connected to the system of the Duquesne Light Co. and other welders up to 2,300 kva. have been considered for connection. In many of these instances the problem of objectionable lighting flicker has arisen on the premises of adjacent consumers or in the plant of the welder user himself. Experience with steps that have been taken to mitigate the effect of such voltage fluctuation on service quality may be of interest.

Where welders have been supplied from the transmission system practically no trouble has been encountered from lighting flicker. No cases have been reported where system voltage regulation was sufficient to cause unsatisfactory welder operation. However, trouble from lighting flicker and low voltage was encountered with welders supplied from 4-kv. distribution circuits where impedances were high in relation to the loads served.

Voltage variation that can be tolerated at the welder appears to vary quite widely. A recent installation was designed to meet a specified customer's limit of five percent voltage drop for nine seam and spot welders aggregating 990 kva. Largest of these was a 200-kva. seam welder. Another case is known where a single 200-kva. welder operated satisfactorily with but 80 percent of name plate voltage at the terminals. Here, however, the electronic control was on a separate circuit with more stable voltage.

Use of Capacitors

Series capacitors have not been used in the primary circuit to reduce flicker and no cases are known where welders with integral series capacitors are served by this company. Due to the high cost of protective equipment for overhead line installations it is believed that the integral type capacitor has the best possibilities where such extreme measures are required. It is understood that a few welders of this type are now in service in other parts of the country.

Interlocking of welders has been used successfully to avoid simultaneous operation. In one instance a customer using a number of welders on intermittent work obtained poor welds when one of the smaller welders was operated simultaneously with the largest one. Signal lights were installed to indicate when the large welder was operating and instructions were issued not to attempt operations of smaller welders when these lamps were lighted. Another similar case involved five large welders and four smaller ones. Here it became necessary to operate only one large welder at a time pending installation of a new connection to the transmission system.

Higher Terminal Voltage

While use of a high utilization voltage for welders will reduce voltage regulation for the customer it is of no particular advantage in eliminating lighting flicker for adjacent customers. Where higher terminal voltage is used lighting flicker could be cut by winding for 4,160 volts instead of 2,400 volts.

The writer's company does not favor use of a common transformer bank to supply both lighting and power loads except where the size of motors, welders, etc. is small in relation to the capacity provided. Separate transformers are generally provided for lighting and three-phase power. Welders are distributed among the phases of the power bank where practical. At some locations separate 2,300 or 4,000-volt transformers have been provided for welder service.

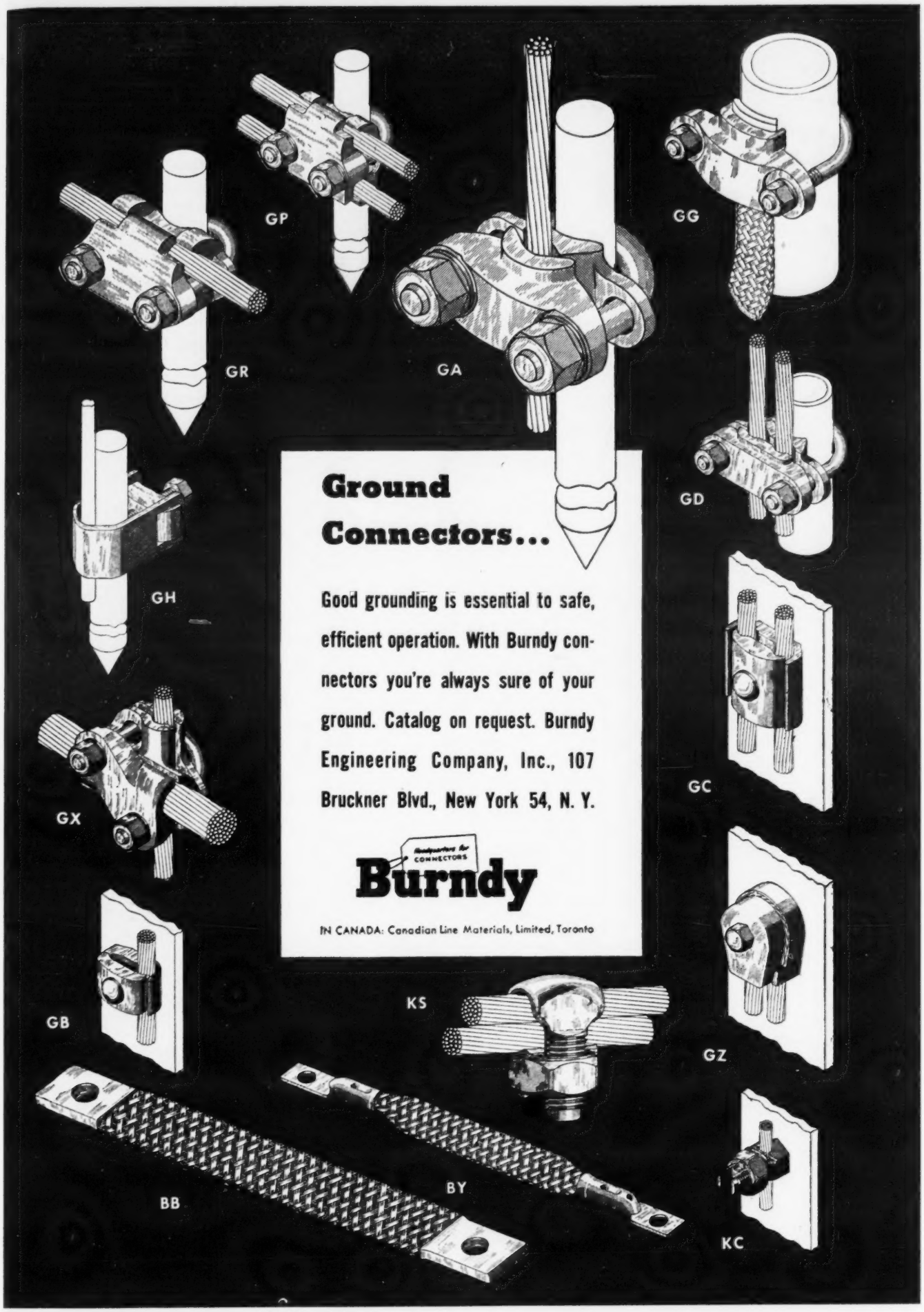
Voltage Translator

The voltage translator* described by Messrs. Askey and Hendrickson (AIEE summer convention 1944) appears to offer excellent possibilities for reducing lighting flicker on distribution circuits resulting from welder or other fluctuation loads. Through its use it should be possible to supply larger fluctuating loads from distribution circuits in certain cases than could be supplied by conventional methods. Most common application in urban areas would appear to be the use of a translator near the first customer on the circuit and extending one or more separate conductors from the point to the welder.

Problems of voltage fluctuation can, we believe, be solved by proper

* This article based on author's discussion of paper, "Welder Power Supply A Problem of Coordination" by Askey and Hendrickson a conference paper presented at the AIEE Convention in St. Louis, June 1944.

* See page 63 this issue of Electrical World.



Ground Connectors...

Good grounding is essential to safe, efficient operation. With Burndy connectors you're always sure of your ground. Catalog on request. Burndy Engineering Company, Inc., 107 Bruckner Blvd., New York 54, N. Y.

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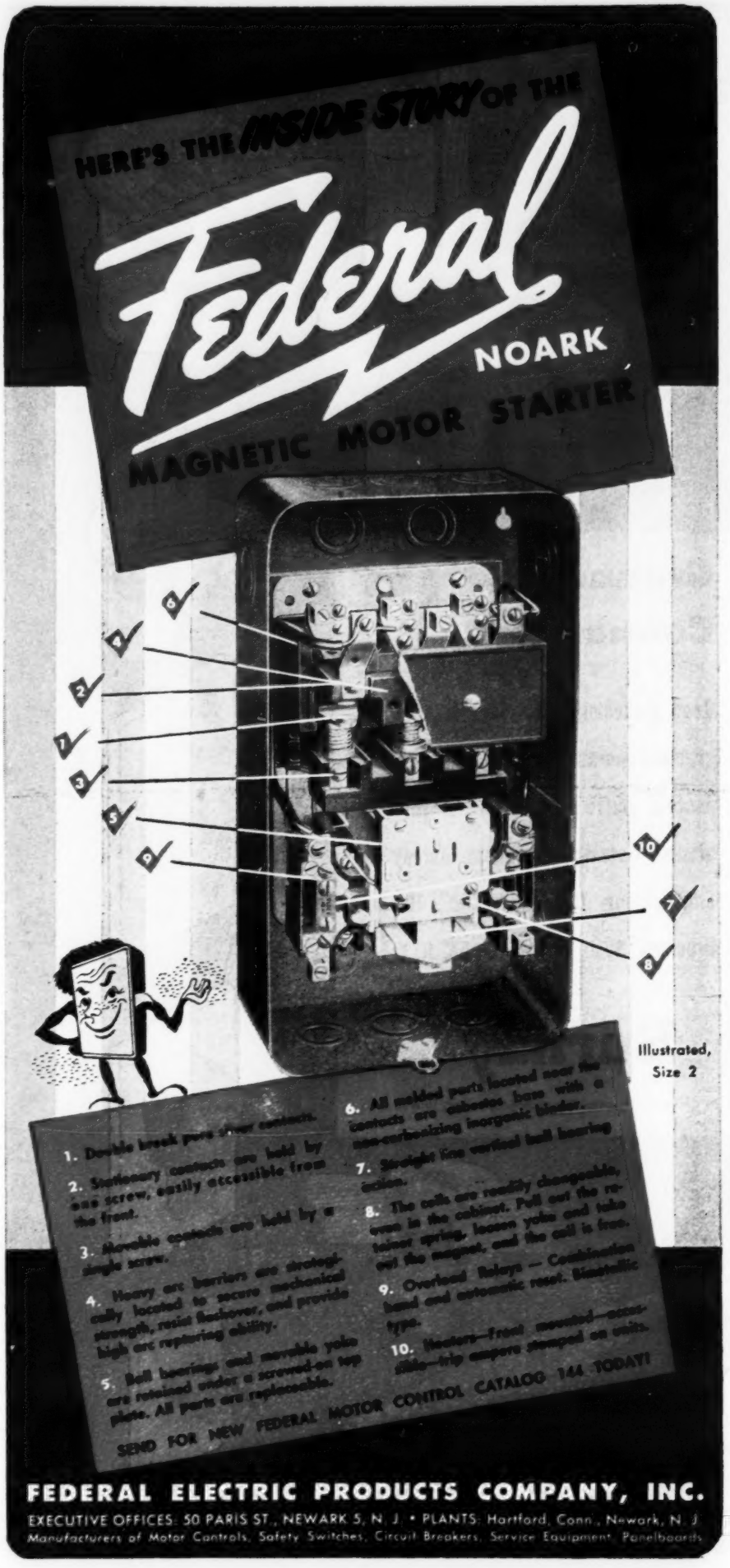
HERE'S THE INSIDE STORY OF THE
Federal
NOARK
MAGNETIC MOTOR STARTER
Illustrated, Size 2
1. Double break pure silver contacts.
2. Stationary contacts are held by one screw, easily accessible from the front.
3. Movable contacts are held by a single screw.
4. Heavy arc barriers are strategically located to secure mechanical strength, resist flashover, and provide high arc rupturing ability.
5. Ball bearings and movable yoke are retained under a screwed-on top plate. All parts are replaceable.
6. All molded parts located near the contacts are asbestos base with a non-carbonizing inorganic binder.
7. Straight line vertical ball bearing action.
8. The coils are readily changeable, even in the cabinet. Pull out the retainer spring, loosen yoke and take out the magnet, and the coil is free.
9. Overload Relays — Combination hand and automatic reset. Bimetallic type.
10. Heaters—Front mounted—accessible—trip ampere stamped on units.
SEND FOR NEW FEDERAL MOTOR CONTROL CATALOG 144 TODAY!
FEDERAL ELECTRIC PRODUCTS COMPANY, INC.
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Manufacturers of Motor Controls, Safety Switches, Circuit Breakers, Service Equipment, Panelboards

cooperation between manufacturers, customers and utilities. Practice of this company in recent years has been to obtain from customers complete name plate data and details regarding proposed duty and operating cycle for each welder in the early stages of installation. Thus we have been able to eliminate most of the troubles which were encountered in early days due to lack of reliable figures on proposed welder operations.

•

Broken Bolt Heads Kept Out of Machine

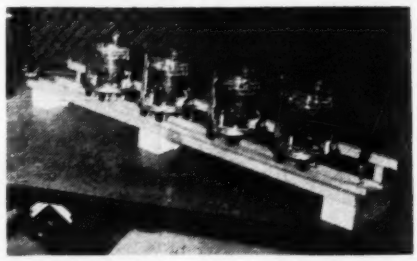
Bolts subjected to continual heating and cooling do break occasionally and the head sometimes drops into the windings of the machine. Thomas Dunn, Engineer, Freeport Municipal Plant, Freeport, N. Y., has drilled holes through heads of the hexagonal bolts on the cleanout plate on the generator end of the plant diesels and strung small iron wire through them.

Should the bolt break and drop out due to vibration it will be retained on the wire and not drop into the generator.

•

Simple Rack Speeds Meter Ground Test

Instead of looping terminals of individual socket meters together preparatory to checking a group for grounds and insulation leakage,

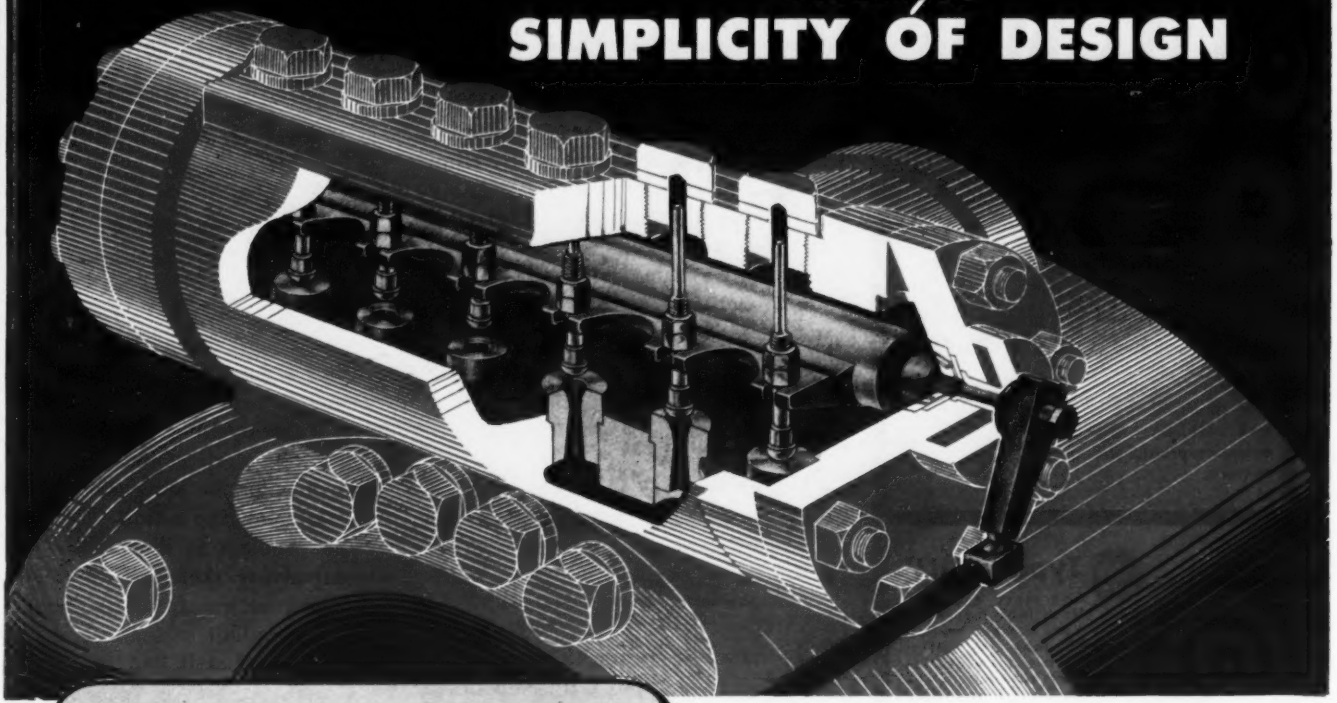


METER TERMINALS resting on the bonded rails of this test rack are connected in series ready for a ground test. Capacity of the rack is eight meters, connections are minimized

metermen at Indiapanolis Power & Light Co. merely line them up on the illustrated test rack and apply potential.

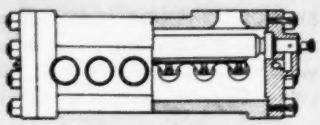
Socket meters are set on the rack, as shown, with current and potential coil terminals resting on two bonded metal rails and their cover rings

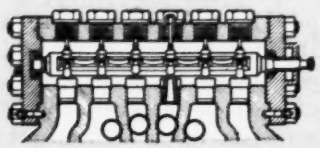
SENSITIVITY OF CONTROL *through* SIMPLICITY OF DESIGN



This HENDY Turbo-Generator feature will pay you dividends

The steam-control valve mechanism of the Hendy turbo-generator is operated by a rocker shaft. In this design there are no valve stems or lifter-bar mechanisms passing through the steam chests; thus friction loss is eliminated and the sensitivity of the system is correspondingly increased. The stainless-steel rotating shaft that lifts each valve successively from its seat is carried in nitrided bearings, insuring free operation in high temperatures and eliminating shaft stuffing or packing boxes.

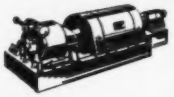




Because of the extreme simplicity of this design, valve adjustments are easily made, and heavy rocker arms, lengthy control linkages, and wasteful steam leakages are eliminated.

This worth-while Hendy feature is only one of many that contribute to lower maintenance costs, greater efficiency in operation—that pay you dividends. Watch succeeding advertisements for details of other dividend-paying Hendy features.

Further descriptive information is available. When requesting detailed information and prices please indicate electrical requirements, steam conditions, and type of service involved.



Developed recently to meet war needs for a matched turbo-generating set of utmost reliability, Hendy turbo-generators are setting new high standards of performance. By simplification of design *throughout*, operating efficiencies are *raised* and maintenance and service problems are *reduced*. Built in one of America's best equipped shops by a corps of skilled craftsmen, these units feature many advancements in turbine, reduction-gear and generator design . . . combined into one complete plant that has received immediate approval by operating engineers.

Hendy turbo-generating plants are available for marine or stationary applications in sizes from 250 to 750 kw. Investigate *now* the many advantages to you of installing Hendy equipment.

JOSHUA HENDY IRON WORKS
ESTABLISHED 1856
SUNNYVALE, CALIFORNIA

S-6718-A

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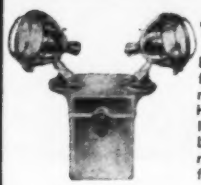
70 MASTER-LIGHTS

for Better, Faster Night Repairs

High Power and Convenience to Increase the Efficiency of Your Line Crews

Type "WS"

A lightweight hand light (250,000 c.p.) concentrated searchlight beam. Penetrates smoke, fog, steam. Range one mile. Rechargeable, corrosion-proof, spill-proof battery.



Type "DUL"

Emergency dual head floodlight for control rooms and key positions. Has long life battery. Illuminates wide area. Lights automatically when regular 115 volt circuit fails.

The Super 6

A powerful, penetrating beam, 6 volt 21 amp. hour, semi-non spillable rechargeable battery. Provides long burning low power consumption service light or brilliant 250,000 cp searchlight (range 1 mile).

Type "T"

Roof Searchlight. Inside Pistol Grip Control. Range one-mile. Most powerful automobile spotlight made. Swings in a complete circle, any angle, up or down. Penetrates fog or smoke. Operates from car battery.

● How quickly your night repair crews are able to end outages depends upon how well they're able to see. 70 Carpenter Masterlights are available to help them speed up night repairs . . . and maintain your customer goodwill.

No more needless groping about in the dark. Types available include worklights, searchlights, floodlights, warning lights, patrol lights, watchmen's lights, and emergency lights for all conditions. 30-day free trial, without any obligation. Send for descriptive literature.

CARPENTER MFG. CO.
Master-Light Makers
167 Sidney St.
Cambridge, Mass.

touching a third electrically isolated "railing" on the rack.

The rails, in series, are connected to the high-potential terminal of a test transformer while the "railing" is grounded. An interlocked gate prevents access to the rack while the potential is applied.

Presence of grounds or leakage, when detected by the operator, is traced to a particular meter by elimination.

Because the presence of grounds and defective insulation is relatively infrequent such a rack as this permits one man to test a large number of meters rapidly; it being unnecessary to make a number of connections each time.

•

Procedure in Handling Pentachlorphenol

By E. A. STANGER
Distribution Manager
Southern Canada Power Co.
Montreal, Canada

In handling pentachlorphenol the same care should be exercised as when handling creosote, sodium fluoride, arsenic salts, etc. in the form of wood preservatives. More specifically, the following precautions are observed in applying the solution, the preparation of which was detailed in the December 9, 1944 (page 119) issue of ELECTRICAL WORLD.

1. Use mechanical means for applying the solution and handling the wood after treatment while it is still wet with solution.

2. The men handling the solution, particularly those handling it day in and day out, should be equipped with protective garments and gloves. Natural rubber cannot be used for this due to the solvent action of the oil. Some of the synthetics, such as "Neoprene", are satisfactory for this purpose.

3. Do not allow employees who have skin eruptions such as acne or pimples or who have chapped skin or broken skin due to burns or abrasions, to handle this solution.

4. Keep exposed areas of the body thoroughly clean by frequent washing with plenty of good soap and lukewarm water.

5. In case of accidental swallowing of the solution send for a doctor and in the meantime give an emetic such as mustard and water, a salt and water, or other means to produce vomiting.

6. The solution is a very efficient weed killer and care should be taken when treating standing poles that crops are not affected by the spray.

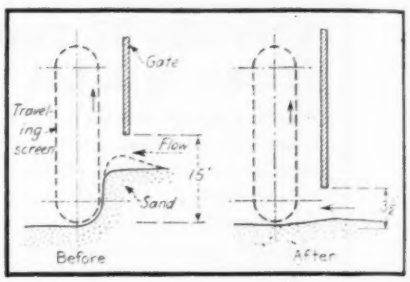
•

Reduced Gate Opening Stops Screen Clogging

By J. F. McLAUGHLIN
Supt. Des Moines Plant
Iowa Power & Light Co.
Des Moines, Iowa

Wear and tear on the traveling screens at the Des Moines power plant of the Iowa Power & Light Co. caused by sand dropping out of suspension, piling up and caving in against the screen has been largely eliminated by the simple expedient of reducing the normal gate opening. The resulting increase in water velocity sweeps the sand through the screens and eliminates the clogging action.

The problem is illustrated in the accompanying sketch. With the gate full open, as was formerly the practice at this plant, water lost much of the velocity that it had in the river



REDUCED GATE OPENING increases water velocity through traveling screens. Prevents sand dropping out of suspension: piling up and caving in against screen

channel and sand dropped out and piled up ahead of the screen as shown. During flood periods the problem was accentuated by the increased amounts of sand in suspension. Pile up was more severe, as indicated by dotted portion of sketch. When sufficient sand had piled up a cave-in followed which made it necessary to close the gate and dig the sand out by hand. This job was not made easier by the fact that often the gate could not be fully closed due to wedging action of the sand.

Cutting the gate opening from 15 to 3½ or 4 ft. for normal operation has completely solved the problem and eliminated a worrysome source of screen maintenance. Just enough gate opening is maintained to prevent a drop in level in the intake tunnel.

SHELDON EV-R-ON LUGS

CUT INSTALLATION COSTS!

WHEN you eliminate heating and soldering in making terminal connections *you save time* — cut installation costs! And when you use Sheldon EV-R-ON Solderless Cable Terminals you save time *safely!*

EV-R-ON lugs are simple to install and connect...a twirl of the Allenhead wrench sets the pressure-bar over the cable—ready for a final quick "clamp" that sinks the pressure-bar teeth into the cable, gripping it under high, non-loosening pressure. Vibration won't bother them. *They can't shake loose!*

EV-R-ON lugs, with high strength copper alloy bodies and Duronze bolts, are guaranteed by the name "Sheldon". Guaranteed by passing the utility industry's toughest tests in the field...and in the laboratory... pull-out, mechanical distortion, heat cycle and conductivity tests.

You can cut installation and maintenance cost, and prevent power interruptions by insisting on Sheldon EV-R-ON Lugs. Write today for specifications and price lists. Sheldon Service Company, 652 Hudson Street, New York 14, New York.

Sheldon EV-R-ON Lugs are available for all cable sizes from 8 solid to 1000 MCM.

Specify "Sheldon" for Precision-Built Electrical Connectors

SHELDON SERVICE COMPANY

SPLITBOLTS ... LUGS ... COUPLERS ... LIMITERS ... CRABS

LOAD SERVICING

Commercial
Industrial

Residential
Rural

Street Lighting Record Control Modernized

By ROBERT JAMES HAYWARD,

Service Inspection and Records Bureau
Consolidated Edison Co. of New York, Inc.

Reorganization of street lighting records, via the punched card method, in Consolidated Edison Co. of New York, Inc. and System Companies was made possible by alphabetical accounting machines. Actual location, description and statistical data of a street lighting installation are combined on one or more cards. Many pertinent items not recorded by the old system were incorporated into the new method.

Hence, complete annual reports of the 235,000 lamps in the City of New York with their 290,000 items of rental are mechanically prepared in a more efficient manner by the Consolidated Edison System for its own operating records and for the verification of quantities in billing the city.

Street lighting records are divided into two major categories: Operating, and Accounting or Billing. The accounting end of the job for billing the city each month is based on the figures or quantities of the operating record. Therefore both operating and billing have a relationship in their subdivisions, Energy and Rental.

Energy billing is based on the number of lights, their wattages and the number of hours they are in use. This billing was performed by the Commercial Relations Department on the basis of operating record figures furnished by the Record Bureau.

Rental billing consists of twelve rental items. A single lamp post installation may consist of any combination of one to four of these items. Most of these posts are owned by the city; some are owned by Consolidated Edison. On these there is a somewhat complex system of billing to obtain rent for their use. This form of billing was done by Controllers Department also on the basis of Record Bureau computations.

By creating punched cards and forms to cover this work, manual preparation of monthly billing became mechanized. Now all computing necessary to determine kilowatt hours for energy billing and quantities for rental billing is done on machines developed by International Business Machines, Inc. Net changes and net balances are mechanically recorded on bill forms and automatically transferred through summary punch machines to punched cards for the ensuing month.

Thus the reorganization of record handling for street lighting operating and accounting purposes centralizes in the Record Bureau and the Machine Tabulating Bureau complete responsibility for this record from A to Z. It has simplified and mechanized the work and made it more efficient because of the elimination of the possibility of human error.

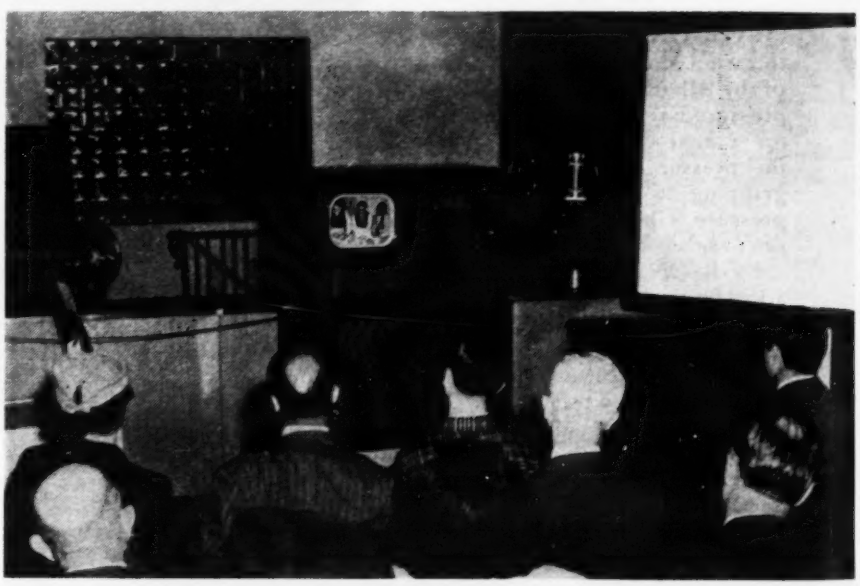
Record changes caused by the wartime dim-out of street lights—first, lower wattage ratings and then increase in wattage when the dim-out was declared no longer necessary—were effected with expeditious efficiency by the improved method.

•

To Cooperate with Farm Equipment Dealers

Agricultural power sales in San Diego County, Calif., will receive a boost after the war with the placing in the field of an agricultural power salesman to cooperate with electrical farm equipment dealers, according to

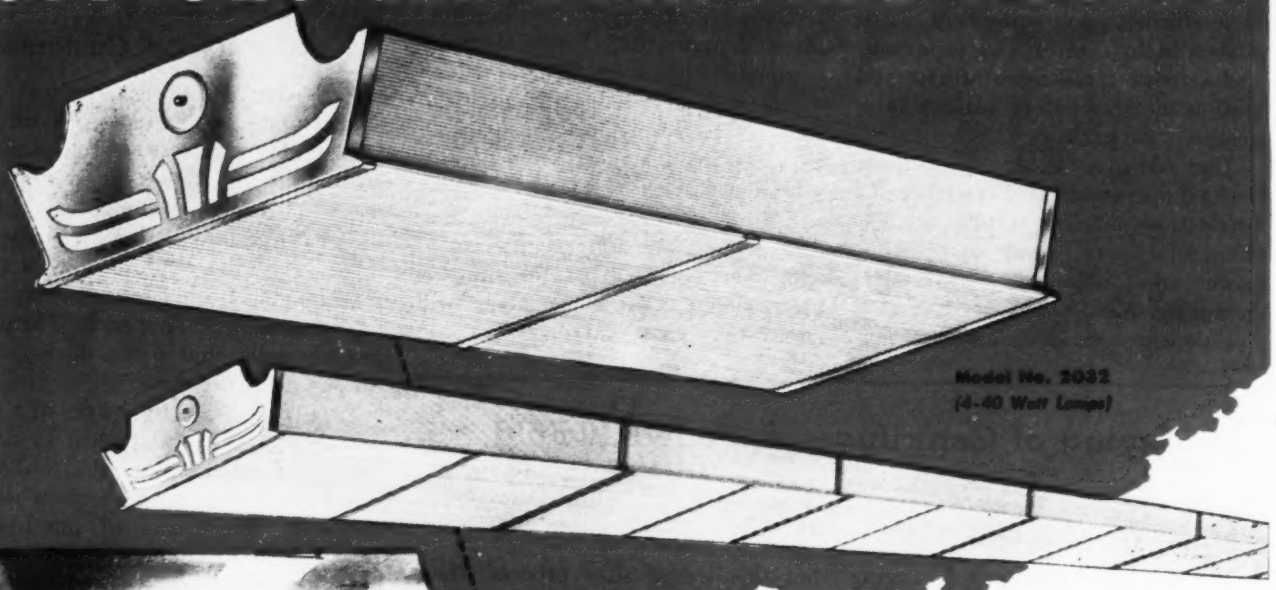
Double Promotion with Television



SPADEWORK FOR THE POST-WAR PROMOTION of both electric cooking and television is being done by Commonwealth Edison Co., Chicago in a cooperative demonstration lecture series being conducted in appliance dealers' stores. Invited to view television broadcasts, customers see and hear electric cooking skits presented weekly over Chicago's Balaban & Katz station WBKB. This show, a sustaining, experimental feature is written and staged by members of the utility's advertising and home service staffs. Reception of the telecast at dealers' stores is followed by a slide talk for the planning of all electric kitchens. The audience above is at the Electric Appliance Mart on Chicago's south side

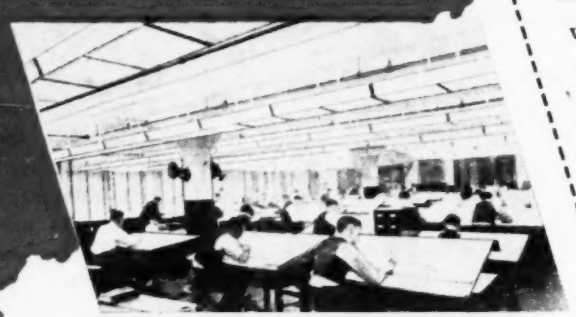
MITCHELL U.R.C. LUMINAIRE

America's
FIRST CHOICE FOR
OFFICES and DRAFTING ROOMS



Model No. 2032
(4-40 Watt Lamps)

Mitchell U.R.C. Luminaires relieve eye strain, increase ease of work and contribute to comfort of employees



Continuous rows of Mitchell U.R.C. Luminaires provide high illumination level without glare over entire drafting room.

HIGH INTENSITY ILLUMINATION WITH LOWEST SURFACE BRIGHTNESS

This is the *original* U.R.C. fluorescent fixture that revolutionized commercial lighting from the day it was first introduced by MITCHELL. This is the unit that brought new lighting efficiency and comfort to office work by combining maximum light output with minimum glare (surface brightness). It is adaptable for every type of interior—pendant or surface mounting, individual or continuous row. Takes less time to install than any other commercial fixture. Same low original price!

To get the original . . . *buy or specify MITCHELL U. R. C. Luminaire*

U.R.C. LUMINAIRE

Get full details from your Mitchell distributor
Or write for U. R. C. Brochure

MITCHELL MANUFACTURING CO.

2525 Clybourn Avenue • Chicago 14, Illinois

West Coast Factory & Sales Office:
1019 N. Madison Ave., Los Angeles 27, Cal.

MITCHELL FLUORESCENT

a plan outlined by P. P. Pine, power sales engineer for the San Diego Gas & Electric Co.

In a meeting held by utility officials and electrical distributors to discuss the promotion of electrical farm equipment after the war, Pine said that the duties of the power salesman would be to cooperate with wholesalers, manufacturers, and dealers in their efforts to sell equipment, assist dealers in their advertising programs, and arrange for demonstrations and motion pictures before various farm groups.

The salesman would also supply data on operating costs and increased production effected by use of electrical equipment. In certain cases the power salesman would assist dealers in closing sales.

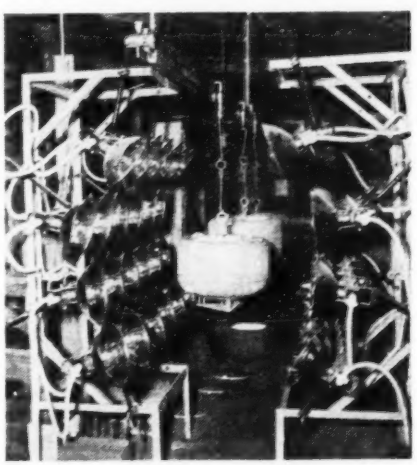
Pine urged the distributors to consider those dealers who now maintain salesmen already making periodic calls on farmers as the logical prospects to handle additional electrical equipment. Those stores handling feed and fertilizer, which farmers visit regularly on coming to town, are also logical outlets for electrical equipment.

"The progressive dealer, ready to reap the post-war harvest, will operate three departments: Farm electrical equipment, home appliances, and a wiring and service department," said Pine. "The wiring and service division will be the most important of all, for it will act as a feeder to bring in prime sales prospects. Because adequate service and repairs are of special importance to the farmer, sales and service departments will complement each other."

Drying of Centrifuges Speeded 10-Fold

By JAMES L. FADEN
Technical Service Division, Boston Edison Co.

Production of centrifuges ranging in capacity from a few cubic centimeters to 3 liters has been increased ten-fold at the plant of the International Equipment Co., Boston, Mass., by the installation of a 15.6-kw. Fostoria infra-red tunnel for baking



ADJUSTABLE infra-red tunnel heats wide range of cylinders and parts of centrifuges used in processing blood plasma

crackle finish on the cylinders and other parts of this apparatus, now used throughout the world in processing blood plasma serum. Formerly these parts were pasted, rubbed down and air-dried with aluminum finish, but this was a slow process which created a bottleneck in the manufacturing operation.

The installation contains a 250-lb. Wright, ½-hp., electric hoist, a Carrigan motor-driven overhead conveyor requiring about 1.8 hp., and a lamp tunnel 5 ft. long, 3 ft. wide inside, and 60 260-watt carbon filament lamps usually worked about 6 to 8 in. from the material being dried. The conveyor provides for varying the speed of transit of the material through the tunnel through a mechanical setting on the conveyor, but in the baking of paint on centrifuge parts the time required ranges from 15 minutes for light material to 45 minutes for heavier work. Cylinder thicknesses vary from $\frac{1}{16}$ in. in smaller capacities to $\frac{1}{4}$ in. in larger units. Cylinders are automatically rotated about 15 times on the way through, and their interiors with white inside finish are baked at the same time by conduction, the temperature along the main interior axis of the oven being about 425 deg. F. maximum.

The lamp equipment includes four rows of six lamps each on each side of the tunnel, as shown, and there have also been added two rows of six lamps each at the bottom. Trumbull control switches enable sections to be cut in or out as desired. Lamp units are about 10 in. apart in each row. A horizontal adjustment of about 4 in. is available in the tunnel, laterally. The bottom rows at the center are not used in baking the smaller pieces of the machines.

•

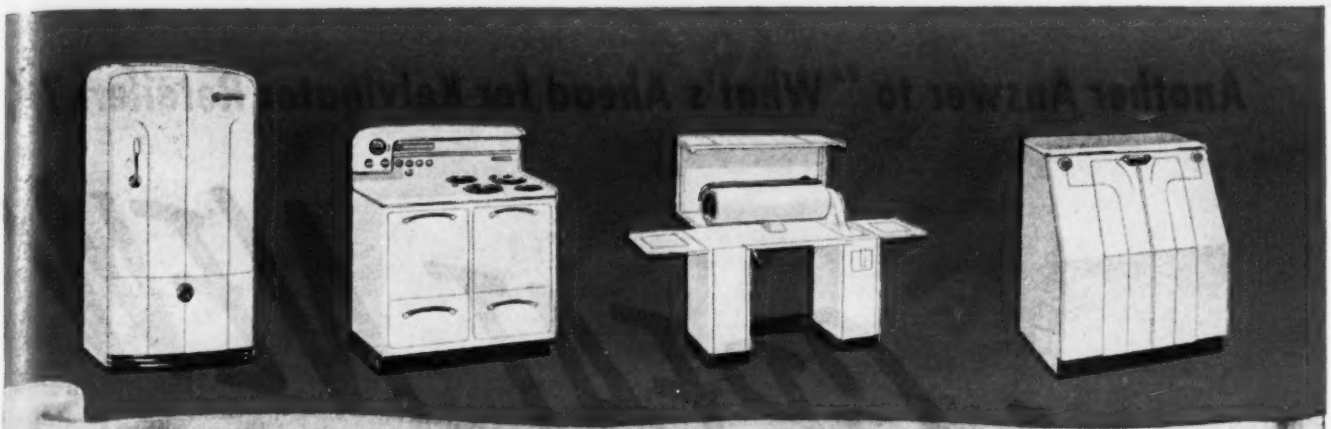
Gravel Pits Make Good Customers

Extension of electric service by central stations to gravel pits offers a desirable post-war day load. In one utility the power sales department added seven such pits with 1,600 hp. in connected motor load in about three years, the requirements of the jobs ranging from a low of 65 hp. to four requiring 300-hp. each. The pits are normally shut down during the three winter months.

In a typical case the owner of a pit had driven all his equipment by belt-connected gasoline engines. Following a fire in which two engines were salvaged, the merits of purchased power were canvassed, with the result that utility service was selected. The situation was competitive, calling for close study of the local conditions and attention after the job was sold. Gasoline engines in this area do work equivalent to about four or five kw.-hr. per gallon. Since this gas was tax exempt, the operating cost was comparable to electricity at about two cents per kw.-hr. The use of electricity requires motors not necessary with direct-drive engines, but which may equal or even exceed the cost of the engines for the same power requirements. Thus, in a typical case, the initial and operating costs were both about on a par, and other factors had to have a tangible value to justify a switch to purchased energy.

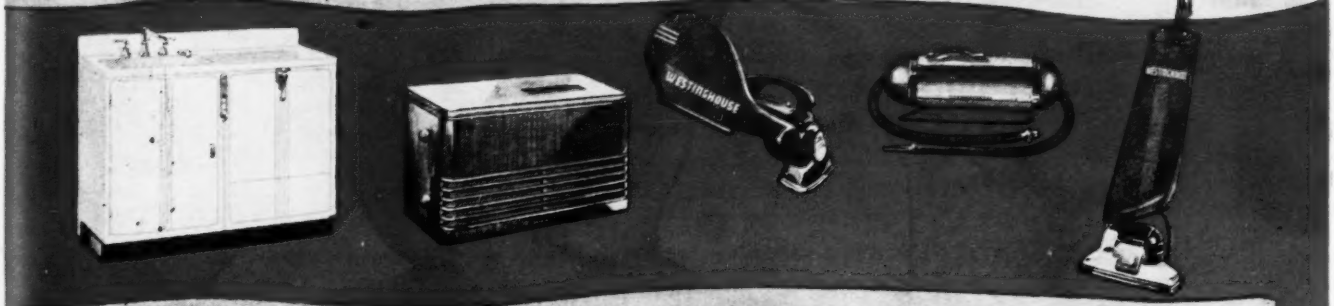
Among these factors are the fire hazard of gasoline, maintenance (considerably greater with engines than with motors), ability with purchased power to operate sections of the pit in case of partial shutdown, and the increased flexibility and convenience of motor drives. Larger pits use diesel engine drives in some cases, and the higher initial investment compared with gasoline engines or motors may or may not be offset by operating savings.

Much depends on a proper analysis of the conditions and insurance

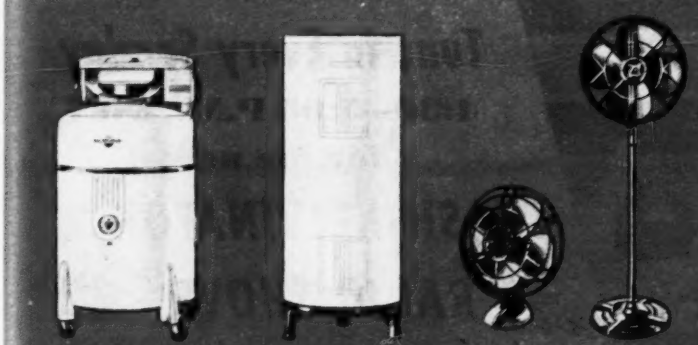


HATS OFF TO WESTINGHOUSE RETAILERS AND

THEIR SERVICE MEN WHO HAVE KEPT



YOUR ELECTRIC APPLIANCES ON THE JOB

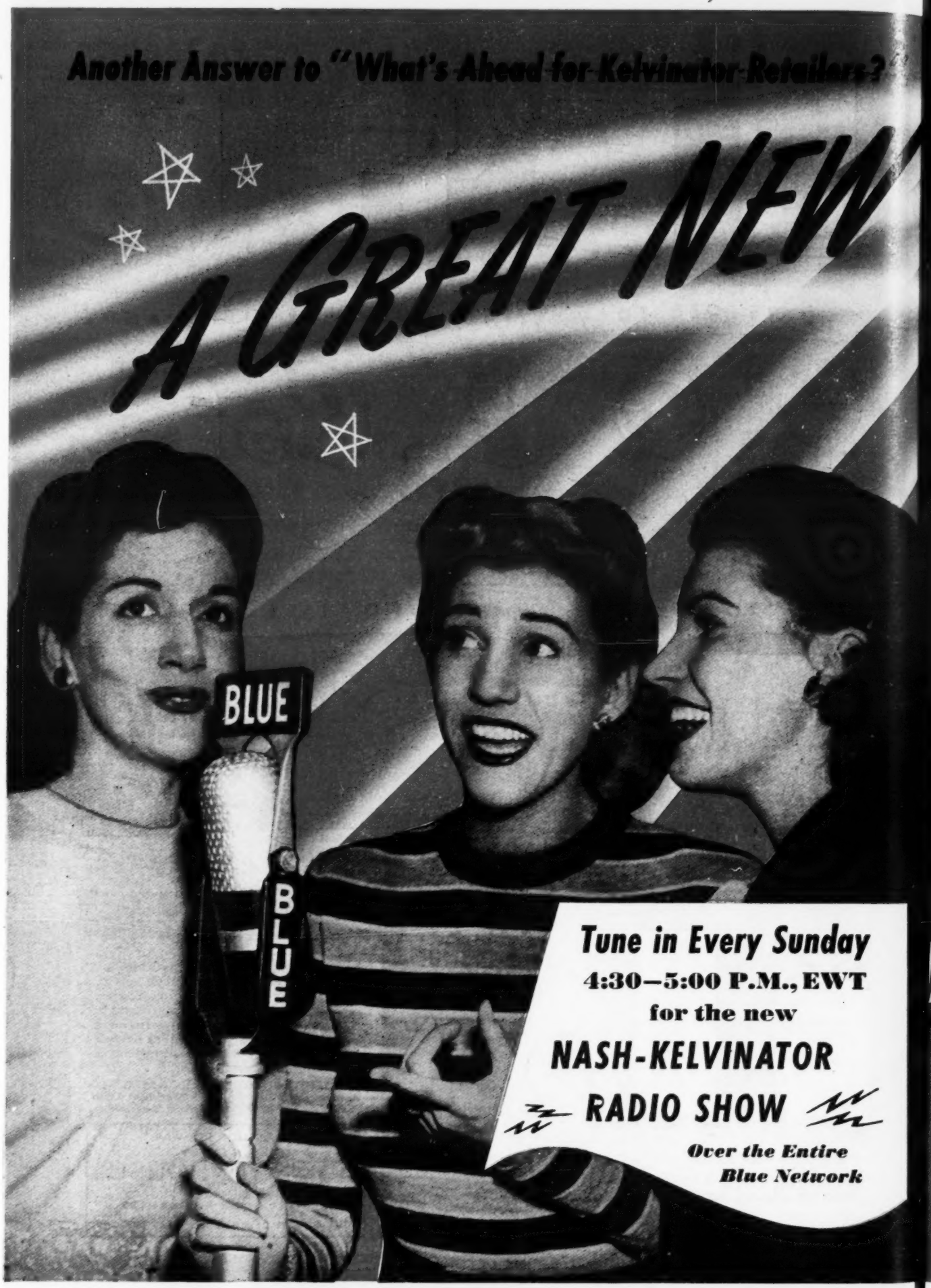


JUNE 16: JOHN CHARLES THOMAS, SUNDAY 2:30 EWT., N.B.C.
HEAR TED MALONE, MON. TUES. WED. EVES., BLUE NETWORK

In the three years since Pearl Harbor, Westinghouse retailers and their service people have, indeed, rolled up a notable record. And as a well-deserved tribute to them we are running this advertisement in full color in the January 20th issue of Collier's and the January 20th issue of The Saturday Evening Post.

WESTINGHOUSE ELECTRIC & MFG. CO.
Appliance Division • Mansfield, Ohio
Plants in 25 Cities . . . Offices Everywhere

30 MILLION PRE-WAR
Westinghouse
ELECTRIC HOME APPLIANCES
YOUR PROMISE OF STILL FINER ONES TO COME


Another Answer to "What's Ahead for Kelvinator Retailers?"
A GREAT NEW
BLUE
BLUE
Tune in Every Sunday
4:30—5:00 P.M., EWT
for the new
NASH-KELVINATOR
RADIO SHOW
Over the Entire
Blue Network

RADIO SHOW

STARRING "THE ANDREWS SISTERS" AND GUEST STARS OF STAGE ★ SCREEN AND RADIO

Now—to the great selling power of Kelvinator's national magazine campaign, Nash-Kelvinator adds the tremendous impact of radio—with a brilliant, new, half-hour musical comedy program broadcast every Sunday over the complete Blue Network of 189 stations, coast to coast.

Featuring the famous "Andrews Sisters," America's top singing trio . . . George (Gabby) Hayes, famous Western movie comedy star of Republic Pictures . . . Vic Schoen and his Decca Recording Orchestra . . . this newest radio show will have as guest stars each week the most famous names of the radio, stage, screen and musical worlds.

And its tremendous audience appeal will win increasingly greater consumer acceptance for the products Kelvinator Retailers will sell when the "green light" for production is given.

This is but one of the dramatic, retail-minded selling programs that will help build sales and profits for Kelvinator Retailers. It is another reason why, postwar, retailers with the Kelvinator Franchise will hold "the most valuable franchise in the Appliance Industry."

LOOK AHEAD WITH KELVINATOR

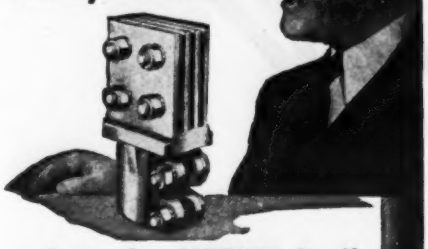
DIVISION OF NASH-KELVINATOR CORPORATION

Kenosha • Milwaukee • DETROIT • Grand Rapids • Lansing

FOR APPLIANCE DISPLAY

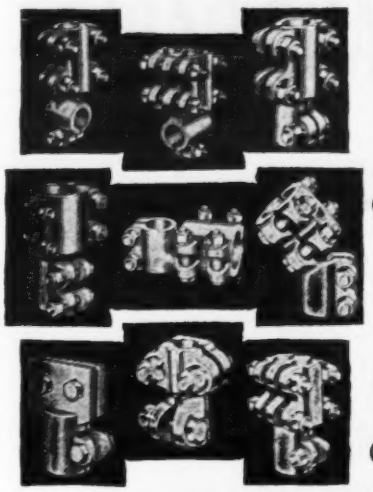
Coming soon—a new book of modern store and appliance department layouts to help Kelvinator Retailers plan for greater sales through better display.

"You select
EXACTLY
what you need—



—from the **COMPLETE** line"

Stud Connectors and **Solderless Terminal Adapters** for distribution and power transformers . . . for connecting to cable, pipe or bus bar . . . in line or at any angle. Connectors with reversible clamping caps take two different ranges of cable sizes. Furnished for any number of conductors. A few of Penn-Union's many types:



Also . . . the most complete line of Service Connectors, Cable Taps, Tees . . . Straight and Parallel Connectors . . . Bus Supports, Spacers . . . Grounding Clamps, Terminal Lugs, etc. etc.

Penn-Union conductor fittings are the first choice of leading utilities, industrials, electrical manufacturers and contractors—because they have found that *"Penn-Union" on a fitting is their best guarantee of Dependability.* Write for Catalog.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

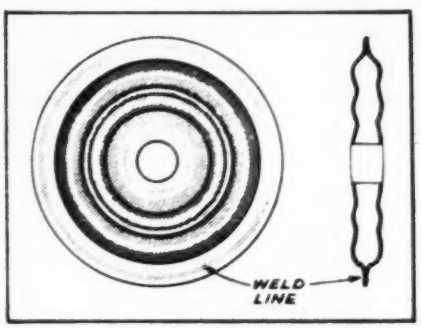
of efficient use of machinery. The utility has found that thorough engineering study of conditions tends toward the successful use of purchased power, supplemented by assistance rendered to such customers in making the best use of their plants. Wiring and motors are carefully checked for proper operation and satisfactory power factor. Graphic demand meters are installed and employees in the pits instructed in controlling loads to avoid excessive peaks. The electrically operated pit requires a minimum of attention in view of the rugged design of motor, service cable and control equipment available, and at the current and prospective levels of labor costs may turn the scale in favor of purchased power.

•

Pressure Gage Diaphragms by Resistance Welding

Seam welding is now employed in the production of diaphragms for sensitive pressure gages. The diaphragms are now manufactured of stainless steel or monel, ranging from 0.006 in. to 0.008 in. in thickness. They were made formerly of beryllium-copper or phosphor-bronze and the edges were crimped and soldered.

As in many cases where resistance welding has been introduced, a reduction in manufacture operations was effected. Where before, two separate



SEAM WELDED pressure gage diaphragms of parts 0.006 in. thick

stampings had to be made allowing an extra flange on one stamping for crimping; now, two sections of the same stamping are seam welded altogether. This has produced a better diaphragm at less cost than was heretofore possible.

The Resistance Welder Manufacturers' Association, Philadelphia, Pa., reports on this problem which is one of many solved by its members to speed up the war effort, as well as to open new horizons for post-war fabrication problems.

•

Plans to Continue Full Dealer Cooperation

By C. H. OSHA
Commercial Manager
Indiana Service Corp., Fort Wayne, Indiana

Preliminary plans for post-war promotion call for the Indiana Service Corp., Fort Wayne, to retain its former program of full dealer cooperation without direct merchandising.

Lighting—Commercial and industrial promotion will be handled by lighting specialists while home lighting will be under the supervision of the home service director. Additional personnel will be trained in lighting technique to permit full development of the market possibilities in lighting.

Wiring—Adequate wiring will be emphasized in post-war promotion with all branches of the sales organization cooperating. A drive to interest and educate builders, electricians and dealers in the necessity for better wiring and to enlist their aid in its promotion has been started and will be continued into the post-war period.

Appliance Sales—Actual merchandising of appliances will be left to the dealers. In this field the company will confine its efforts to general promotion and to cooperation with the dealers.

General features of the plans are:

1. *Advertising* — Newspaper, outdoor and direct mail advertising will be used to promote "electric living." The facilities of the company's "Leisure Electric Home," under the supervision of the home service department will also be used to sell this basic idea.

2. *Sales Promotion*—Campaigns at regular intervals will be employed to unify the efforts of dealers and renew their enthusiasm.

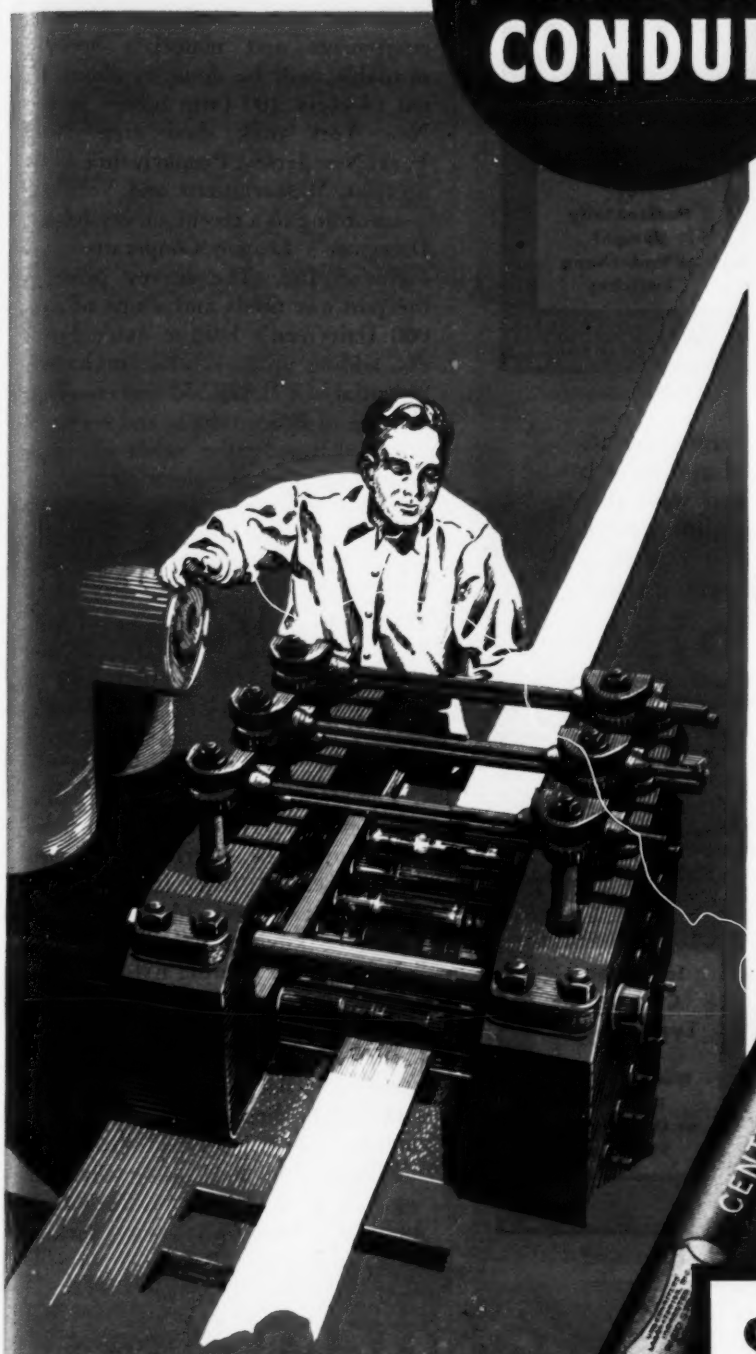
3. *Displays*—Space in the company's commercial office and Leisure Electric Home will be available to dealers for display of their merchandise.

4. *Meetings*—Group meetings of dealer salesmen will be held in the company's Leisure Electric Home for group training in general or specific phases of the salesmen's work.

5. *Home Service*—All phases of home service work will be designed to develop prospects, to assist dealers

CENTRAL RIGID STEEL CONDUIT

...is made from our own world famous SPANG PIPE...assuring the user of "Controlled Quality" in every phase of manufacture



In the operation shown the strip steel is uncoiled from spools and one end is fed into the Leveling Rolls which "Iron out" the coiled strip flat and straight prior to welding strips end to end, for processing into Continuous Weld Pipe from which CENTRAL CONDUIT is manufactured.

"There's Tested Strength in Every Length"

SPANG-CHALFANT

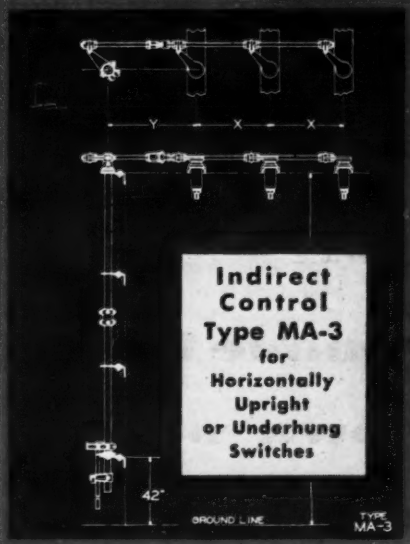
Division of The National Supply Company

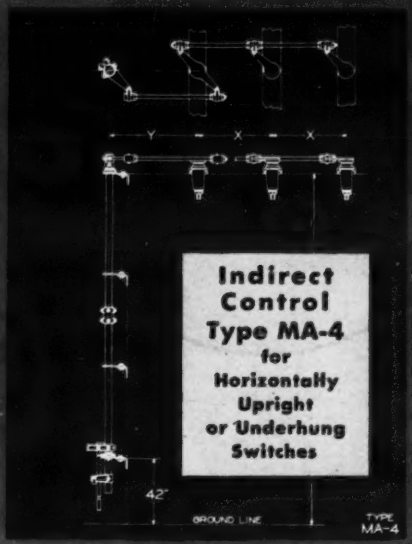
General Sales Office: Grant Building, Pittsburgh 30, Pa.

District Offices and Sales Representatives in Principal Cities

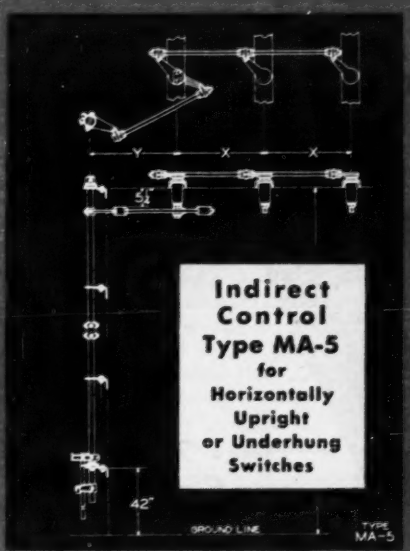
Specific Switch Operating Functions are met with versatile

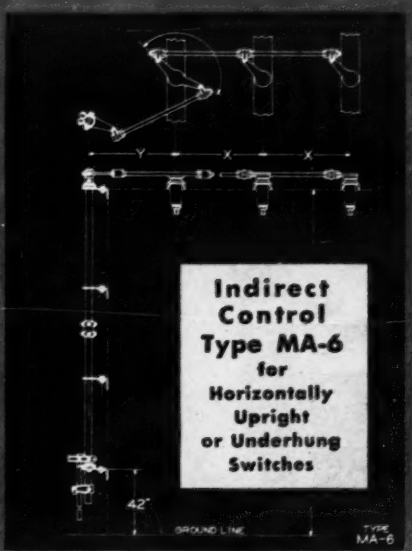
HI-VOLTAGE Switch Arrangements





Shown are several typical mechanism arrangements that can be used with any one type Hi-Voltage Switch . . . No field drilling or cutting is required with this type of mechanism. They are completely machined, ready to install, at the factory. Installation time is a part of your switch cost. You'll find a real saving when Hi-Voltage mechanism is used.





HI-VOLTAGE
EQUIPMENT COMPANY
2891 East 79th Street • Cleveland 4, Ohio

in closing the sale and to keep the appliances sold after delivery.

The program as outlined is essentially that in effect before the war. Results have been most satisfactory and will be continued in the post-war period.

•

Electrical Market in New York Milk Shed

Kitchen modernization, as soon as equipments and materials become available, will be done in about 15 out of every 100 farm homes in the New York milk shed area—New York, New Jersey, Pennsylvania, Connecticut, Massachusetts and Vermont—according to a recent survey by the Dairymen's League Cooperative Association Inc. The survey presents the post-war needs and wants of 28,000 Dairymen's League dairy farmers, adding up to a total purchasing potential of $91,428,352 and covering a range of 225 products and services.

Listed among the needs of these 28,000 farmers are electricity in the home, 8.3 percent; in outbuildings, 5.9 percent; in barns, 8.3 percent; water systems in the home, 11.1 percent; in the barn, 14.3 percent. Milking machines are needed by 11 percent, incubators by 0.6 percent, brooders by 6.7, electrical fences by 16.7 percent, battery chargers by 1.8, motors by 16.7, switches by 6.7, milk coolers by 14.3.

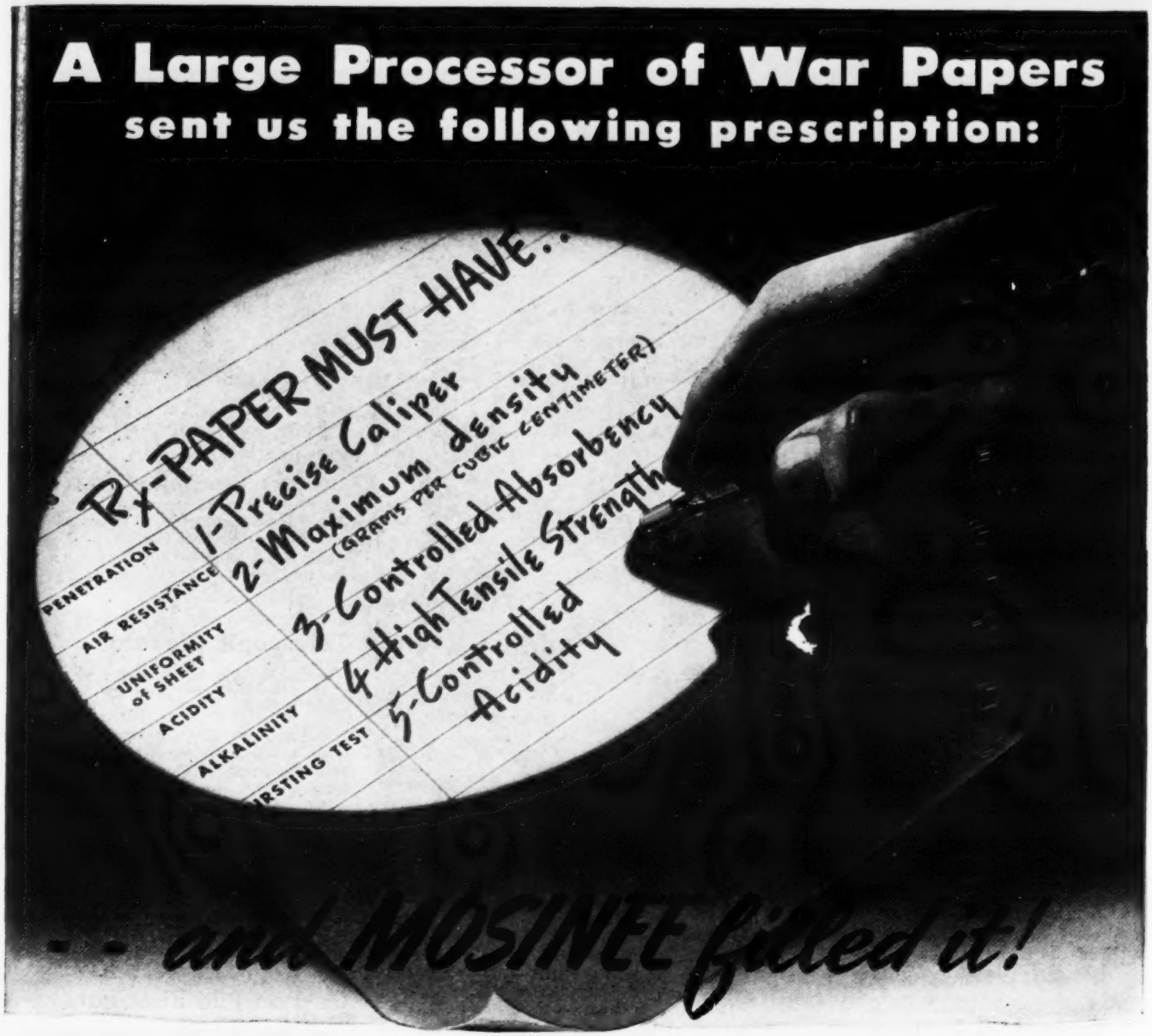
The foregoing are needs, according to the survey. Here are the farmers' wants in things electrical; refrigerators, 25 percent; home freezing units, 25 percent; washers, 14.3; dish washers, 2.1; kitchen lighting fixtures, 7.7; bathroom lighting fixtures, 11.1; kitchen ranges, 6.7 (not specified as electric; but a sales opportunity); toasters, 14.3; vacuum cleaners, 6.7; radios, 25; flatirons, 12.5; television sets, 7.7; kitchen mixers, 12:5; water pumps, 12.5; heating pads, 7.7; heating lamps, 1.9; clocks, 25; more wiring, 14.3; more receptacles, 16.7; more switches, 14.3; more sockets, 14.3; more plugs, 16.7.

•

Six-Ton Dishwashing Task

Six tons of tableware are washed each year by the average farm wife. An electric dishwasher eliminates 240 hours from kitchen duties.

A Large Processor of War Papers sent us the following prescription:



A "Paper Prescription" filled by MOSINEE takes all the guesswork out of the selection of the proper paper for your manufacturing processes.

MOSINEE can be "engineered" specifically for your needs, with absorption, strength, density, thickness, acidity, or other characteristics geared to your processing or treating materials.

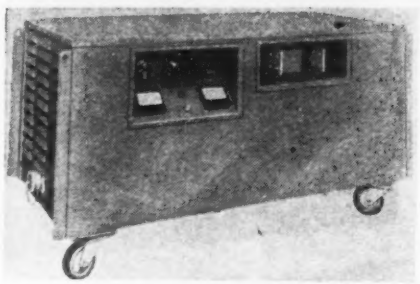
Thus, MOSINEE can aid you in speeding up your war production, and help you in your progress on post-war products.

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers

Please address your letter "Attention Dept. B"

NEW EQUIPMENT

Rectifier Unit

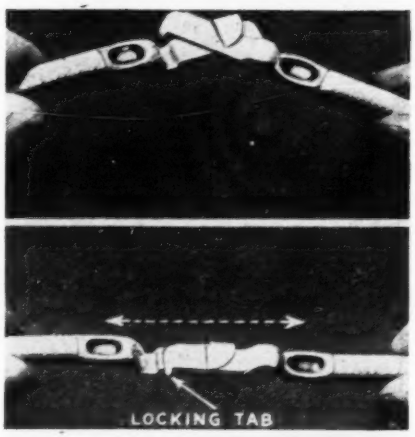


Mobile rectifier unit, supply 440 v. at 25 C.; output 1500 amp. continuous; **W. Green Electric Co.**, 130 Cedar St., New York 6, N. Y.

Rectifier unit mounted on rubber-tired, swivel wheels for ease of movement to the job; also provided are sling holes for crane handling. The output voltage of the selenium rectifier assembly has eight step adjustment from minimum of one to maximum of six volts. Output terminals and control panel (which is equipped with fan switch, pushbutton for main contactor control, voltage adjustment switch, pilot lamp, overload warning signals, volt and ammeters) are recessed in the cabinet wall. One end of the cabinet has a weatherproof receptacle for the 25-ft. supply cable; both ends have "rain-proof" louvers for air intake and exhaust.

•

Self-Locking Clasp

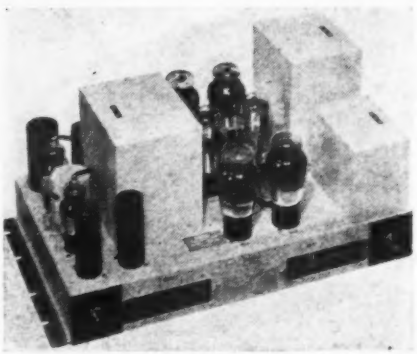


Self-locking quick-disconnect type of electrical connector; four sizes accommodate 10 sizes of cable (No. 18 to No. 8); **Burndy Engineering Co., Inc.**, 107 Bruckner Boulevard, New York 54, N. Y.

Clasp is composed of two identical halves which slide together in jackknife fashion and lock together with a slight pull. This is said to prevent loosening or pulling-apart in service should the cable be subjected to an inadvertent pull or jerk. Connection is said to be easily and quickly opened by pushing the halves together and giving them a slight swing. The clasp, which is made of silver-plated copper, is said to have high electrical efficiency and to have resistance to corrosion.

•

Amplifiers



No. 101 Series amplifiers; **Langevin Co., Inc.**, 37 W. 65th St., New York, N. Y.

Amplifiers are designed for commercial continuous service. All models in the 101 series are said to deliver 50 watts to a nominal load impedance with less than 3 percent rms. harmonic distortion at 400 cycles. Gain control is stated to provide continuous adjustment over a 40 db range and bridging connections.

•

Timer

Type CR7503-F170 weld and sequence timer; supply 230/460/575 v. at 60 c.; **General Electric Co.**, Schenectady, N. Y.

Weld and sequence timer designed to provide the various time and current adjustments during welding operations on air-hardened steels. The control adjusts the time of current flow and its magnitude for preheating, welding, grain refinement, and tempering. Control consists of nine time intervals, seven independent adjusters, two time pressure intervals, one squeeze timer, on hold timer, and provision for two-stage foot switch, all housed in a steel enclosure.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Rheostat

Model "J" 50-watt and model "H" 25-watt rheostats; operating temperature range —67 deg. F. to +158 deg. F. **Ohmite Manufacturing Co.**, 4835 Flournoy St., Chicago 44, Ill.

Units are linear or taper wound in various resistances as desired. Has off position. Totally enclosed in a compact, corrosion-resisting metal container. Units are made in accordance with latest AN-R-14a specifications.

•

Telescopic Elevator

Lightweight portable telescopic service elevator; structural steel; **Revolator Co.**, North Bergen, N. J.

Portable elevator for servicing of overhead lighting fixtures, overhead heaters, etc. at a height not over 24 ft. Unit collapsed is 7-ft. high. It is made of lightweight structural steel and is said to be rigid. Platform is designed to accommodate two men with tools. Among safety features reported are auto-type steering, independent floor lock, self-closing brake and broken cable safety which holds platform stationary in the event of cable break.

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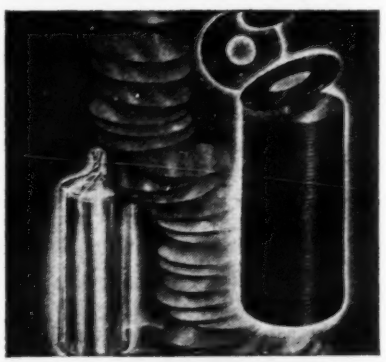
Carbon Pile Rheostats



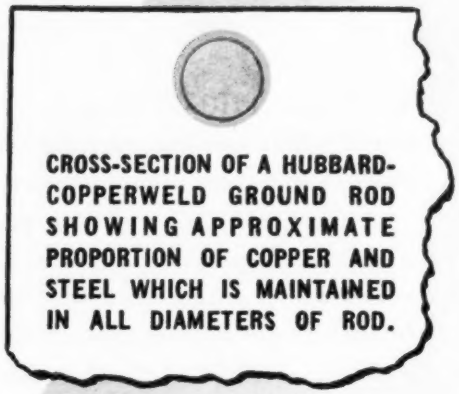
Carbon pile continuously adjusted rheostat; **Stackpole Carbon Co.**, St. Marys, Pa.

Adjustable carbon rheostats formed of carbon disk piles are said to be available in practically any length and diameter of pile required. Resistance is said to be varied by the application of pressure to the pile. Typical range of resistance of the units is shown by that of a carbon disk pile 1½-in. long composed of 0.432-in. diameter disks which permits a resistance range of from 60 ohms with 1-oz. pressure to 0.3 ohms at 32-lbs. pressure. This pressure may be applied electrically, mechanically, centrifugally or hydraulically.

HUBBARD-COPPERWELD

GROUND RODS AND CLAMPS

Grounding Wire
Safety Screw
No. 9492 Clamp
Five safety screw wrenches are furnished with every 100 clamps
Square Head Bolt
5/8" Diam. Hubbard Copperweld Ground Rod
No. 9592 Clamp


CROSS-SECTION OF A HUBBARD-COPPERWELD GROUND ROD SHOWING APPROXIMATE PROPORTION OF COPPER AND STEEL WHICH IS MAINTAINED IN ALL DIAMETERS OF ROD.

RODS—DIAMETERS FROM 3/8" TO 1"—LENGTHS FROM 5 FT. TO 40 FT.

CLAMPS—TWO STYLES, SAFETY SET SCREW AND SQUARE HEAD BOLT—FOR ALL DIAMETERS OF RODS.

HUBBARD AND COMPANY

EXCLUSIVE NATIONAL SALES AGENT FOR
COPPERWELD GROUND RODS AND CLAMPS

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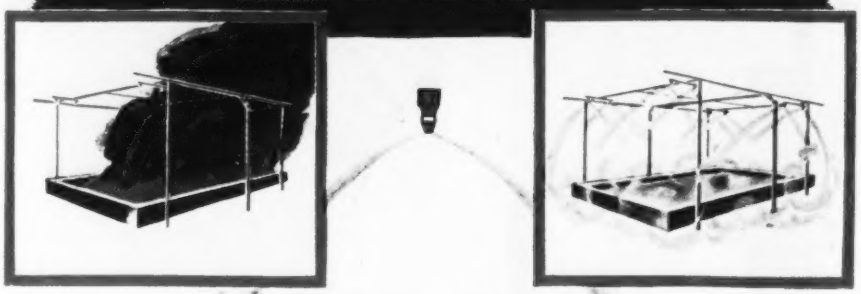
IF YOU SHOULD DOUBT—

that "Automatic" FIRE-FOG quenches flammable liquid fires!

LET US SHOW YOU!



"Automatic"

FIRE-FOG

★ IT BLANKETS ★ IT ISOLATES ★ IT QUENCHES ★

● Would FIRE-FOG prove effective in quenching oil fires?—that was the question. What better way to answer than to make an actual fire test?

A test-tank 5'6" x 9' was partially filled with fuel oil, a quart of gasoline used to set off the fire, and in 20 seconds the entire area was ablaze. It was permitted to burn for one minute and thirty seconds.

Then FIRE-FOG "took command."

From strategically located nozzles misty sprays of FIRE-FOG blanketed the burning oil—*and in 37 seconds the fire was extinguished!*

The conclusion is obvious. When a particularly dangerous fire hazard exists, no matter what its nature, ask us to show you *how* and *why* an "Automatic" FIRE-FOG System will provide adequate protection. Entirely automatic in operation, FIRE-FOG goes into action when fire breaks out, and in almost less time than it takes to tell, it *blankets . . . isolates . . . and quenches.*

"Automatic"

"Automatic" manufactures and installs a complete line of fire protection devices and systems for all types of fire hazards. Write for complete information—we'll furnish it cheerfully.

"Automatic" SPRINKLER CORPORATION OF AMERICA

YOUNGSTOWN, OHIO . . . OFFICES IN 31 CITIES

TECHNICAL LITERATURE

Frequency Etch—A six-page illustrated technical booklet which will be supplied to all interested on the subject of etching quartz oscillator plates. Included are specific hints on etching as well as a series of graphs showing the relationship between etching time and the increase in frequency of BT crystals. Obtain by writing Hudson American Corp., 25 West 43rd St., New York City.

Lighting Maintenance—"Hints on Lighting Maintenance" is a booklet applicable to industrial plants, industrial buildings and factory yard areas. Contains the hows and whys for cleaning, relamping, inspection and repairs. Other subjects treated are safety practice, correct voltage essential to efficient lighting, painting, testing methods and a maintenance check chart for fluorescent and incandescent lamp equipment. Copies may be procured from Westinghouse Electric & Manufacturing Co., Edgewater Park, Cleveland, Ohio.

Productive Coloration—A leaflet describing a system of utilizing color and the reflective quality of paints to help increase efficiency, output and safety in industry. Contains a chart which presents a series of color combinations planned to provide maximum reflectance values, enables one to visualize how and to what degree, by color treatment of walls, ceiling, floor, etc., increased plant illumination can be obtained. Copies may be obtained by writing on company letterhead to Building Products Division, L. Sonneborn Sons, Inc., 88 Lexington Ave., New York 16, N. Y.

Non-Metallic Basic Materials—Bulletin GF 15 lists six non-metallic basic materials with their properties and uses. Tables are used throughout to list properties and illustrations to show typical uses. Copies may be obtained from Continental-Diamond Fibre Co., Newark 15, Del.

Symposium on Plastics—A 200-page book containing 16 papers providing extensive data on important problems in the field of plastics and in another section entitled Summary of Properties, Uses, and Salient Features of Families of Plastics, there is given information on applications, properties, etc. The following families of plastics are covered in this section: phenolic materials, urea and melamine plastics, allyl plastics, rigid and nonrigid vinyl plastics, polystyrenes, cellulose plastics, methacrylate, and nylon plastics. Copies may be obtained from A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia 2, Pa.; $2.00 for blue cloth binding and $1.75 for heavy paper cover.

Porcelain Enamel—An eight page booklet containing a description of porcelain enamel as well as an explanation of representative applications. It also includes a discussion of the general considerations involved in engineering design of porcelain enamel products, and material on fabricating. A full page of diagrams is included illustrating correct design principles. Copies may be secured by writing to Porcelain Enamel Institute, Washington 5, D. C.

Textile Materials—"Standards on Textile Materials with Related Information," 1944 edition, contains definitions, tests such as to evaluate fire retardant properties, resistance to insect pests, water, microorganism, etc.; then follow specifications for asbestos bast and leaf fibers, cotton, glass, rayon and silk, wool and others. Appended material includes charts and tables, proposed specifications and tests and abstracts of technical papers. Copies of the 490-page book are available from American Society for Testing Materials, 260 South Broad St., Philadelphia 2, Pa., at $2.75 each.

Here's information you can use, NOW!

New FIBERGLAS* ELECTRICAL INSULATION MATERIAL BOOKLET . . . TELLS WHAT TYPE TO USE, WHERE AND HOW . . .

This free, new booklet will be helpful to anyone concerned with the specification or application of electrical insulation.

It will help you determine which of the many types of Fiberglas electrical insulation materials should be used for a specific job.

The booklet will show you where this better insulation material can be used advantageously for electronic, radio and electrical applications.

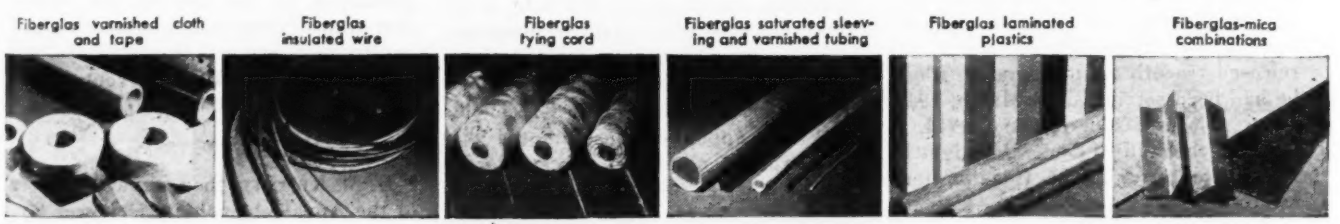
It will indicate the ways to use Fiberglas electrical insulation material to obtain all of the benefits which it affords.

Containing complete information about Fiberglas, the new booklet illustrates Fiberglas fibers and filaments twisted into yarns, served on wires, woven into tapes and cloths, braided into sleevings and formed into tying cords.

It describes the unique combination of electrically and mechanically important characteristics of Fiberglas such as: high temperature, moisture and acid resistance, favorable space factor and high tensile strength. It shows how the insulating impregnants increase the effectiveness of Fiberglas' inherent characteristics and add others such as high dielectric strength, insulation resistance and resistance to abrasion.

You will see why the use of this basic, inorganic, insulating material is increasing so rapidly—why so many designers, manufacturers and repair shop operators prefer it.

Be sure to have a copy of this new booklet in your file for ready reference. Write for your copy today —there is no obligation. Address: *Owens-Corning Fiberglas Corporation, 1858 Nicholas Building, Toledo 1, Ohio. In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.*



FIBERGLAS

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ELECTRICAL INSULATION MATERIAL

NEWS ABOUT PEOPLE

E. R. de Luccia New Head of FPC Bureau of Power

E. Robert de Luccia, who has been named chief of the Federal Power Commission's Bureau of Power (ELECTRICAL WORLD, December 30, page 3), was graduated from Massachusetts Institute of Technology in 1927 with a B.S. degree in civil engineering, having

Signal Corps, U.S. Army

majored in hydroelectric engineering. After graduation, he was affiliated with the Metropolitan Water Commission of Boston before joining Stone & Webster. He later joined the War Department as a civilian employee before transferring in 1938 to the FPC serving in each of the engineering sections.

Formerly assistant chief of the Bureau of Electrical Engineering and assistant director of FPC's National Defense Power Staff, Mr. de Luccia was released recently by the Army in which he had been serving since March, 1942. He went overseas in January, 1944, to serve on the staff of General Dwight D. Eisenhower at Supreme Headquarters. He returned to inactive status with the rank of Lieutenant Colonel.

•

▶ EDWARD J. KELLEY has been appointed executive assistant for public relations with the Narragansett Electric Co., Providence, R. I. Mr. Kelley is a native of Worcester, Mass., and has had a diversified newspaper career, beginning with the Worcester Telegram and later being connected with the Associated Press in Boston, Montpelier, Vt., and New York City. For the past six years he has been chief political writer for the Providence Journal and Evening Bulletin. The Narragansett utility is a part of the New England Power System.

•

Bay State Utility Makes Operating Assignments

President Fred C. Abercrombie of the Western Massachusetts Electric Co., Greenfield, announces the retirement as of December 30 of Charles F. Mosher, general superintendent, following 37 years of service. His successor will be his assistant, Arthur L. Davis. Robert R. Habberley, superintendent of distribution, Springfield division, has been named assistant general superintendent. Howard J. Caldwell, whose headquarters were formerly at Amherst, and more recently at Greenfield, has been named vice-president in charge of operations, succeeding the late Fred L. Hunt, and Clifford A. Clark becomes Mr. Caldwell's assistant. Charles E. Bankwitz, of Turner Falls, has been appointed manager, and Arthur G. Gibson assistant manager of the central division. Joseph L. Hyland of Turners Falls becomes assistant superintendent of the central division, under O. A. Browne. J. F. Burt, Pittsfield division, has been made general sales manager. George Keegan, of the right-of-way department, succeeds to the late J. J. O'Connell's public relations responsibilities with headquarters at Springfield.

Harold E. Bailey, in charge of the new business department in Greenfield, has been appointed Easthampton district superintendent. He succeeds Warren S. Wheeler, district superintendent for about 13 years, who has resigned to enter private business.

Bernard J. Dowd has been appointed superintendent of distribution for the Springfield division of the company, succeeding Mr. Habberley. Mr. Mosher, retiring general superintendent, has been named a director of the company.

Stone & Webster Official Assumes New Duties

Russell T. Branch, who was recently elected president of the Stone & Webster Engineering Corp. (ELECTRICAL WORLD, December 30, page 16), has spent more than 30 years with the Stone & Webster organization during which period he has been successively superintendent of construction, construction manager, vice-president and senior construction manager, and executive vice-president.

Mr. Branch joined the Stone & Webster staff following graduation from

R. T. Branch

Stevens Institute of Technology in 1912. He has supervised and directed many outstanding projects in the public utility and industrial fields and during the present war has devoted substantially his entire attention to the management of important ordnance and other projects essential to the war effort designed and constructed by the corporation for the U. S. Government.

John R. Lotz, who was elected chairman of the board after serving eight years as president, has been identified with Stone & Webster for 37 years. During his association with the organization he has directed the execution of many important engineering and construction projects in the utility and industrial fields. He will continue to have an active part in company affairs.

•

▶ H. M. KEMMER, food service engineer of the Appalachian Electric Power Co., Huntington, W. Va., has resigned after 23 years service with the American Gas & Electric Service Corp., parent company of the Appalachian Electric Power Co. Mr. Kemmer has joined the staff of The H. F. Behrhorst & Son, Inc., of Pittsburgh, Pa., which sells processed foods to the restaurant, hotel,

Continental-Diamond
Engineered Dielectric Materials

DIAMOND
Vulcanized Fibre

The DIAMOND Vulcanized Fibre part illustrated is a handle for a welder's torch. It is made from tubing. DIAMOND Vulcanized Fibre is used for this part because DVF is tough, strong and light in weight... because it insulates electrically and thermally. The handle is economically made from DVF because DVF is readily machined, formed, spun, sawed or otherwise fabricated. For complete technical data on this C-D NON-Metallic, write for catalog DF.

KA-14

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The Plastics

DILECTO—A Laminated Phenolic.

CELORON—A Molded Phenolic.

DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.

HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

The NON-Metallics

DIAMOND Vulcanized FIBRE

VULCOID—Resin Impregnated Vulcanized Fibre.

MICABOND—Built-Up Mica Electrical Insulation.

Standard and Special Forms

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

Descriptive Literature

Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

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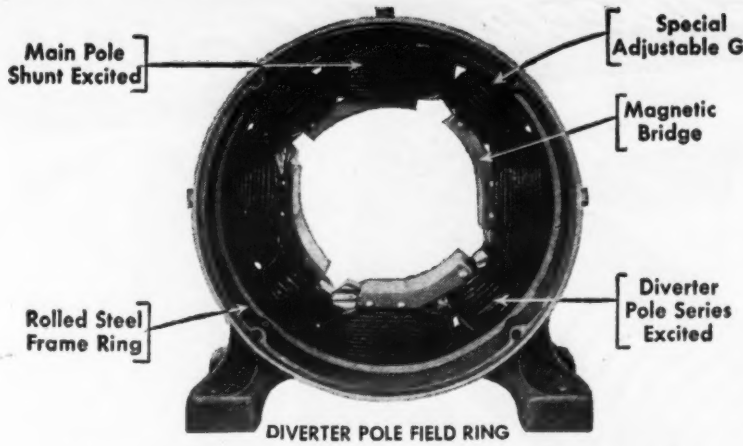
Continental-Diamond FIBRE COMPANY

Established 1895.. Manufacturers of Laminated Plastics since 1911—NEWARK 15 • DELAWARE

WHAT IS GOOD BATTERY CHARGING?



DIVERTER POLE FIELD RING

Your Answer is Found In The DIVERTER POLE MOTOR-GENERATOR

What is Required Of A Standby Battery Charger → **What the DIVERTER POLE MOTOR-GENERATOR Provides**

A—Must provide a closely regulated charging rate, enough to compensate for losses and maintain the battery in a healthy fully charged condition.

A—A closely controlled charging rate is dependent on a constant charging voltage at all times, which is an inherent feature of the Diverter Pole generator.

B—Must be fully automatic in operation requiring only period inspection.

B—Automatic operation is dependent on the inherent characteristics of the charger, which will repeat exactly, indefinitely. This is fundamentally characteristic of the Diverter Pole generator.

C—Must be dependable to the extreme.

C—Dependability is primarily a function of mechanical and electrical design. The Diverter Pole Generator is unusually conservative as evidenced by very low temperature rise and all manufacturing operations are most carefully inspected and tested to meet the highest standards.

D—Must reduce to a minimum transmission of any noises to the circuits and must be mechanically quiet.

D—The Diverter Pole provides this mechanically by design requiring only a gentle motion of air for adequate cooling — electrically by a knowledge of the design factors controlling electrical circuit noises.

E—Should share all loads within safe capacity with the battery and shift excess load onto the battery.

E—This means a constant charging voltage over the working range of the machine and an abrupt drop in voltage at all loads in excess of safe capacity. The action of the Diverter Pole field with the magnetic bridge provides this inherently in the Diverter Pole.

F—Must be inherently protected from any damage of variation of characteristics in the event of a discharge of the battery through the generator.

F—The Diverter Pole principle eliminating a compounding field permits armature current flow in the reverse direction without change of magnetic polarities. With the Diverter Pole principle, protection from severe overloading is secured by a drop in voltage to relieve and protect the Motor-Generator.

Send for Bulletin No. 96 For Complete Details—

The Electric Products Co.
1731 CLARKSTONE ROAD • CLEVELAND 12, OHIO

hospital, institutional, and industrial trade. Mr. Kemmer has established an outstanding record during his ten years residence in Huntington among food service operators there and throughout the country in promoting commercial electric cooking. He won First Prize in the national contest sponsored by the Edison Electric Institute in 1939 and Fourth Prize in 1940. Mr. Kemmer has been a contributor to ELECTRICAL WORLD.

•

D. B. Sinclair Assumes New Engineering Duties

General Radio Co. has announced the appointment of Dr. Donald B. Sinclair as assistant chief engineer in charge of circuit development.

A native of Winnipeg, Manitoba, Dr. Sinclair received his education at the

University of Manitoba and the Massachusetts Institute of Technology. Prior to joining the General Radio engineering staff in 1936, he was a research assistant at M.I.T. from 1932 to 1935, and a research associate in 1935 and 1936.

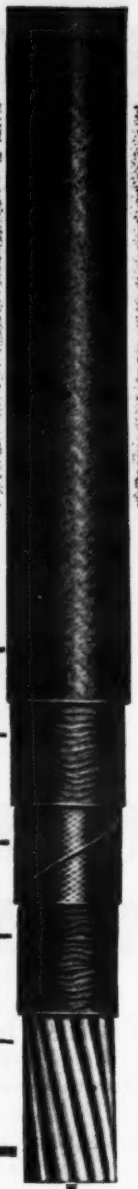
Dr. Sinclair is a fellow of the Institute of Radio Engineers.

•

► WALDEMAR SETON, JR., has been appointed treasurer of the Portland (Ore.) General Electric Co., succeeding Raymond E. Brennan, retiring treasurer and controller. Mr. Seton has been connected with Portland General Electric for 17 years. He is a graduate of the University of Oregon.

► JOHN L. SAVAGE, chief design engineer of the U. S. Bureau of Reclamation, Denver, Colo., has been awarded the John Fritz medal. Mr. Savage has engaged in construction work on Boulder, Grand Coulee and Shasta dams and on several Tennessee Valley Authority dams. The medal is awarded by the American Institute of Electrical

HERE'S WHAT ROCKBESTOS A.V.C. DOES UNDER SEVERE OPERATING CONDITIONS



RESISTS HEAT
" FLAME
" OIL
" GREASE
" FUMES
" MOISTURE
WON'T BAKE BRITTLE
" DE-CENTER
" BLOOM
" BURN
" ROT

Rockbestos A.V.C. Power Cable, at left, and similarly insulated Motor Lead Cable (National Electrical Code, Type AVA) has a maximum operating temperature rating of 110° C. (230° F.) and this permanently insulated construction:

1 A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.

2 Outer felted asbestos wall, impregnated with heat, flame and moisture resistant compounds, serves as an effective barrier against high ambient temperatures and flame.

3 Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat, flame and oxidation between two felted asbestos walls.

4 Felted asbestos insulation, also impregnated with heat, flame and moisture resisting compounds, withstands conductor heating overloads and won't dry out, bake brittle or burn.

5 The conductor is perfectly and permanently centered in helically applied insulation.

One of 122 different wires and cables developed for severe operating conditions by Rockbestos.

Here's the wire you want for all those well-known trouble-spots such as soaking pits, forging presses, steam tunnels, lehrs, kilns and hot strip mills—because it's designed especially for operation under unusually severe conditions—with insulation that will stand up through years of trouble-free service.

Rockbestos A.V.C. has a *permanent* basic insulation of impregnated asbestos which will withstand temperatures up to 230° F. without baking or cracking. It is also resistant to flame, moisture, oil, grease and corrosive fumes and won't rot, bloom, flow, swell or de-center.

Decide now to eliminate expensive wire-failures and equipment shut-downs. You'll find a suitable wire for *every* hot-spot location among the 122 standard Rockbestos constructions. When ordering or inquiring, please furnish CMP allotment symbol and certification. For samples and complete information, write nearest district office or New Haven.

ROCKBESTOS A.V.C. 600 VOLT SWITCHBOARD WIRE
(National Electrical Code, Type AVB)

Sizes No. 18 to No. 4/0 AWG with varnished cambric and impregnated asbestos insulation and gray, black, white or colored flameproof braid.

Combine fire insurance and fine appearance in your switchboards with Rockbestos Switchboard Wire. It is fireproof and will not dry out under heat. Sharp, clean bends can be made without cracking as the asbestos wall acts as a cushion under the braid. Rockbestos A.V.C. Hinge Cable and Switchboard Bus Cable have the same fireproof and heat-proof characteristics.

ROCKBESTOS 600 VOLT ALL-ASBESTOS RHEOSTAT
(National Electrical Code, Type A1)

Sizes No. 18 AWG to 1,000,000 CM insulated with a heavy wall of felted asbestos, covered with a rugged asbestos braid finished in black, white or colors.

Use this power and rheostat cable for wiring rheostats, switchboards, elevator and locomotive control panels and electrical equipment exposed to heat, fumes and fire hazard. Also for general open wiring in dry, high temperature locations. For solid conductor specify Rockbestos Rheostat Wire, Table A.

ROCKBESTOS PRODUCTS CORPORATION
974 Nicoll St., New Haven 4, Conn.

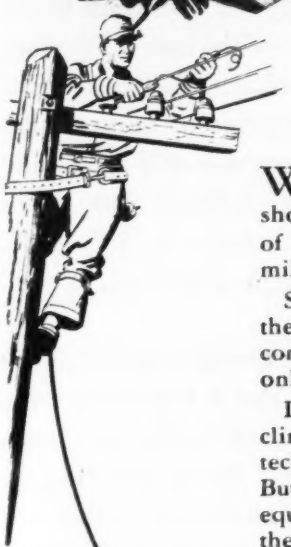
NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

ROCKBESTOS A.V.C.

THE WIRE WITH PERMANENT INSULATION

• BUY MORE WAR BONDS •

every LINEMAN a KLEINMAN!



WHEN Mathias Klein first dedicated his little forge shop to the manufacture of fine tools, the new force of electricity was just beginning to affect the lives of millions of American citizens.

Since that time, one generation of linemen has passed the word to the next: that for the tough job of keeping communications open—of keeping power flowing—only the best in equipment is good enough.

Linemen's pliers and wrenches, belts and straps, climbers and grips have kept pace with the amazing technological advancement in the electrical industry. But this equipment today has this in common with the equipment that the pioneer lineman used—it still carries the name Klein.

In 1945, as when the first wires were strung, America's linemen are still Kleinmen.

ASK YOUR SUPPLIER

Foreign Distributor:
International Standard Electric Corp.
New York

This book on the care and safe use of tools will be sent without charge upon request.

Since 1857

Mathias KLEIN & Sons
Established 1857 Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

Engineers, the American Society of Mechanical Engineers, the American Society of Civil Engineers and the American Institute of Mining and Metallurgical Engineers.

▶ ROBERT A. NEAL, vice-president in charge of apparatus sales of the Westinghouse Electric & Manufacturing Co., has been awarded the honorary degree of doctor of engineering by the University of New Hampshire. The citation emphasized Mr. Neal's contributions to the development of lightning arresters, capacitors and network protectors, his "energetic and outstanding business leadership" and award of the Westinghouse Order of Merit.

•

Promotions Announced by California Board

Changes in organization have resulted in several promotions in the public utilities department of the California Railroad Commission, E. F. McNaughton,, director of the department has announced.

Separate divisions have been established for gas and electric operating and rate problems, Roy A. Wehe having carried on those duties since his appointment in April 1, 1944, as assistant director of the department. C. T. Mess, with change in title to chief, division of valuation, will continue to have responsibility for inventory and appraisals, accrued depreciation and rate base determinations.

Charles W. Mors has been appointed research engineer, succeeding Walter B. Wessells, who had temporarily carried on in charge of the research division as well as the telephone and telegraph division since the latter's appointment as telephone and telegraph engineer last June.

Robert P. O'Brien has been named electrical engineer in charge of the electric division and Lloyd E. Cooper has been made gas engineer.

Mr. Mors became associated with the commission in 1937. He participated in numerous utility regulatory investigations until his appointment in 1943 as research engineer in the transportation department. With the present appointment he returns as research engineer in the public utilities department. Before joining the commission staff, he engaged in technical work in the Bell Telephone Laboratories as well as in operations on industrial electrical applications.

Mr. O'Brien became connected with the commission in 1938, and has since then been engaged in general regulatory investigations dealing with valua-

WILL THIS HAPPEN TO YOUR POST-WAR LIGHTING PLANS?

Many post-war lighting plans will be obsolete before they leave the drafting boards... Others will never reach the stage of installation ... They will be out-moded because they had been prepared without knowledge of the revolutionary, precedent-shattering

LIGHT FLUX ANALYSIS

This technique, developed during the war emergency, radically changes lighting conceptions, setting up entirely new standards of present-day illumination.

Now this new procedure can be revealed... Get the basic facts about LIGHT FLUX Analysis—and its proper application to your individual post-war lighting projects.

Consult Holophane Engineers

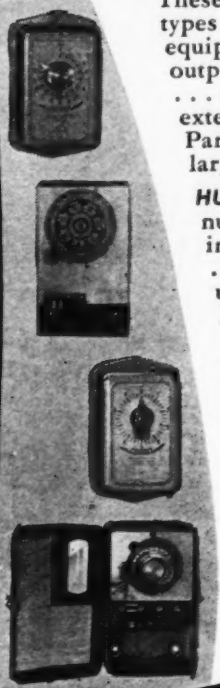
Holophane design and research engineers at headquarters collaborate with application engineers in the field in two broad endeavors: (1) to explore and develop new advancements in illumination generally; (2) to provide the efficient and economical solution to any specific lighting problem...The Holophane Engineering Department offers, without charge, consultation and specifications as a service to architects and engineers.

HOLOPHANE COMPANY, INC..... *Lighting Authorities Since 1898*

342 MADISON AVENUE, NEW YORK 17 • Holophane Co., Ltd., 385 Yonge St., Toronto, Can.

IT'S TIME TO INVESTIGATE TIMERS

WHEN PLANNING your future stocks or installation work, get full information about Paragon Automatic Time Controls . . . because they offer possibilities for handsome profits. These instruments are used in plants of all types and are built into numerous kinds of equipment. They save time . . . multiply human output . . . reduce errors . . . increase efficiency . . . and lower costs. Because they have been extensively used and are widely advertised, Paragon controls offer you the opportunity of large future sales.



HUNDREDS OF APPLICATIONS—Some of the numerous applications of timers are: Protecting component parts, such as electronic tubes . . . Automatically turning air conditioning units on and off . . . Sequence Timing . . . Laboratory Testing . . . Conveyor Control . . . Light Exposure . . . Heat Treating . . . Pump Operation . . . Machinery Operation . . . Plastic Molding . . . Time delay on pump back spin...Controlling pre-heating schedules.

CALL THE PARAGON REPRESENTATIVE . . . for assistance in selection and correct application of Paragon controls.

PARAGON ELECTRIC COMPANY

703 Old Colony Building • Chicago 5, Illinois

Paragon Chicago

BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905

tion, rate base, and depreciation.

Under the plan of operation, Mr. Wehe is normally responsible for the planning and conduct of major formal and informal rate investigations, special investigations as assigned, and coordination of the work of the gas and electric divisions. In the absence of the director, he has general charge of the department.

•

Worthington Pump Board Elects New Officers

Directors of the Worthington Pump & Machinery Corp. have elected Clarence E. Searle as president to succeed Harry C. Beaver, who was made vice-chairman of the board and chairman of the management committee.

Mr. Beaver has been president of the corporation since 1931 and Mr. Searle has been vice-president in charge of sales since joining the Worthington organization in 1932. He previously had a long period of service in various executive capacities with the Allis-Chalmers Manufacturing Co. of Milwaukee.

Hobart C. Ramsey, vice-president in charge of operations, was elected executive vice-president. Edwin J. Schwanhausser, vice-president in charge of manufacturing and sales operations in Buffalo, was made vice-president in charge of sales, and Leslie C. Ricketts, manager of the corporation's Harrison works, was elected a vice-president.

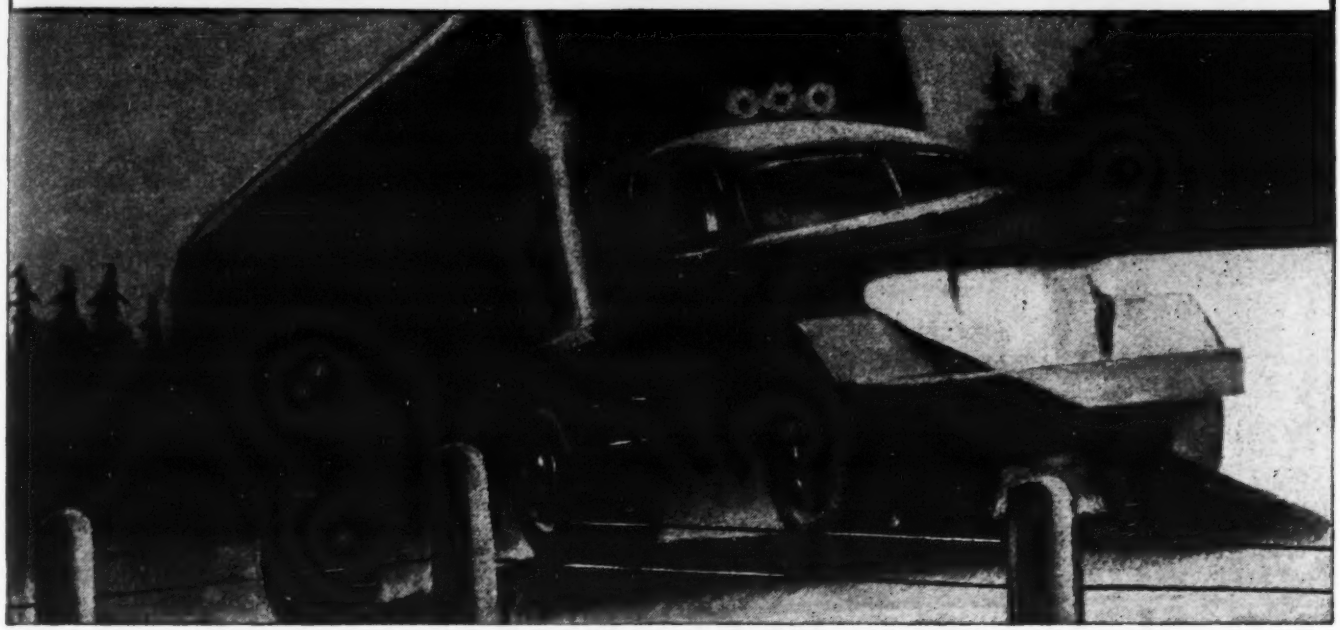
•

► F. L. GEMMER has been appointed advertising and sales promotion manager and ERIC E. DEMARSH chief field engineer of the Burndy Engineering Co., Inc. A graduate of Massachusetts Institute of Technology, Mr. Gemmer was formerly associated with the Aluminum Co. of America for a number of years. Mr. DeMarsh has been identified with Burndy Engineering for the past eight years. He is a graduate of the Rensselaer Polytechnical Institute.

► B. H. HAVENS has been appointed sales manager of the condenser division of the Noma Electric Corp., New York, N. Y. Mr. Havens, who has had many years of experience in the radio components field, will direct the merchandising of Noma condensers through sales representatives and parts jobbers in all key cities throughout the United States.

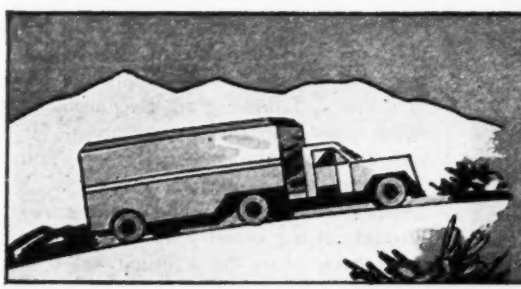
► CHESTER K. STERRETT, industrial engineer, has been added to the staff of the industries department of the Portland (Ore.) Chamber of Commerce in preparation for an intensive drive to develop

Better in the Long Run



In spite of prolonged shortages of vehicles, replacement parts and personnel, the motor truck transportation industry successfully has performed a tremendous task in supplying the nation's critical needs swiftly and economically. Now, a limited number of Ward LaFrance heavy-duty trucks for civilian use is available . . . trucks designed and engineered to respond quickly under all conditions and loads.

Our twenty-five years of truck manufacturing, plus the experience gained in producing specialized vehicles of war, enables us to build better civilian trucks capable of meeting every demand with reliability and low maintenance cost. Remember that, in the long run, trucks engineered to do a *specific* job do it better! Why not investigate by writing our Sales Department today?



WARD LAFRANCE

TRUCK DIVISION

GREAT AMERICAN INDUSTRIES, INC. • ELMIRA, NEW YORK

A Quick, One-Man Test for Bonds

AND OTHER LOW-RESISTANCE CONTACTS

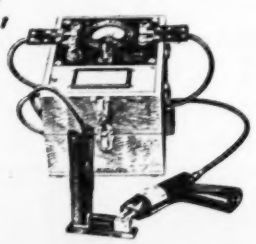
The Shallcross Aero Gun Model Low-Resistance Test Set can be used rapidly and efficiently by one man. Operation is positive and simple. Without previous technical training, an inspector can do a quick, accurate job of bond testing on a "Go, No-Go" basis, demonstrating instantly whether an electrical bond or joint is good or bad by comparison with a predetermined standard.

The Aero Gun Model is completely self-contained. The exploring probes extend from the muzzle, the battery is in the barrel, the control equipment and indicating meter are on the butt facing the operator, and the cable to the fixed clamp is attached to the pistol grip. Low-resistance comparison tests can be made by the hundred—faster than by any other method. Write for Aero Gun Model Catalog.

- Weight with battery, only 5.25 pounds.
- Ranges 0.003 and 0.3 ohms, or 0.005 and 0.5 ohms.
- Accuracy calibrated ± 3% at full scale.
- Overall length, 12".
- Price, $80.

OTHER TYPES FOR LABORATORY, FIELD OR PRODUCTION USE

Shallcross Low-Resistance Test Sets were first produced over 10 years ago. Since then, hundreds of sets in use on a wide variety of jobs have proved the outstanding advantages of this method of testing.... The present Shallcross line includes Test Sets for practically every field service, laboratory, or industrial production line requirement. Write for the complete Low-Resistance Test Set Catalog.



SHALLCROSS MFG. CO.

DEPT. EW-15 COLLINGDALE, PA.

ENGINEERING • DESIGNING • MANUFACTURING

Portland industry. For 18 years, Mr. Sterrett has been in charge of the industrial development division of the Cincinnati Gas & Electric Co. The acquiring of the services of Mr. Sterrett is part of the program of the Portland chamber of expanding existing industries and bringing new ones to that section. Mr. Sterrett is a graduate of the University of Cincinnati. For the past year, he was chairman of the smaller industries committee organized in Cincinnati by the committee for economic development. He also was a consultant for the WPB and the Smaller War Plants Corporation in Cincinnati.

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Copper Association Adds to Engineering Staff

Announcement has been made of the following additions to the staff of field engineers of the Copper Wire Engineering Association: F. Carlin Gray, N. R. Malone and Kenneth G. Eaton.

Mr. Gray will be situated in Washington, D. C., and will cover the territory east of the Mississippi River and south of the Ohio River, including the State of Ohio. Mr. Gray was formerly with the Copperweld Steel Co., Glassport, Pa.

The territory west of the Mississippi River and north of the Ohio River, exclusive of the State of Ohio, and as far west as the States of Minnesota, Iowa, eastern Kansas, Oklahoma and part of Texas will be covered by Mr. Malone, with headquarters in St. Louis. Mr. Malone was co-director of line extensions in the rural division of the Pennsylvania Edison Co., Altoona.

Mr. Eaton, who will be located in Denver, Colo., will cover the western half of the United States, or all of the remaining territory. He was formerly identified with the Rural Electrification Administration as an engineer.

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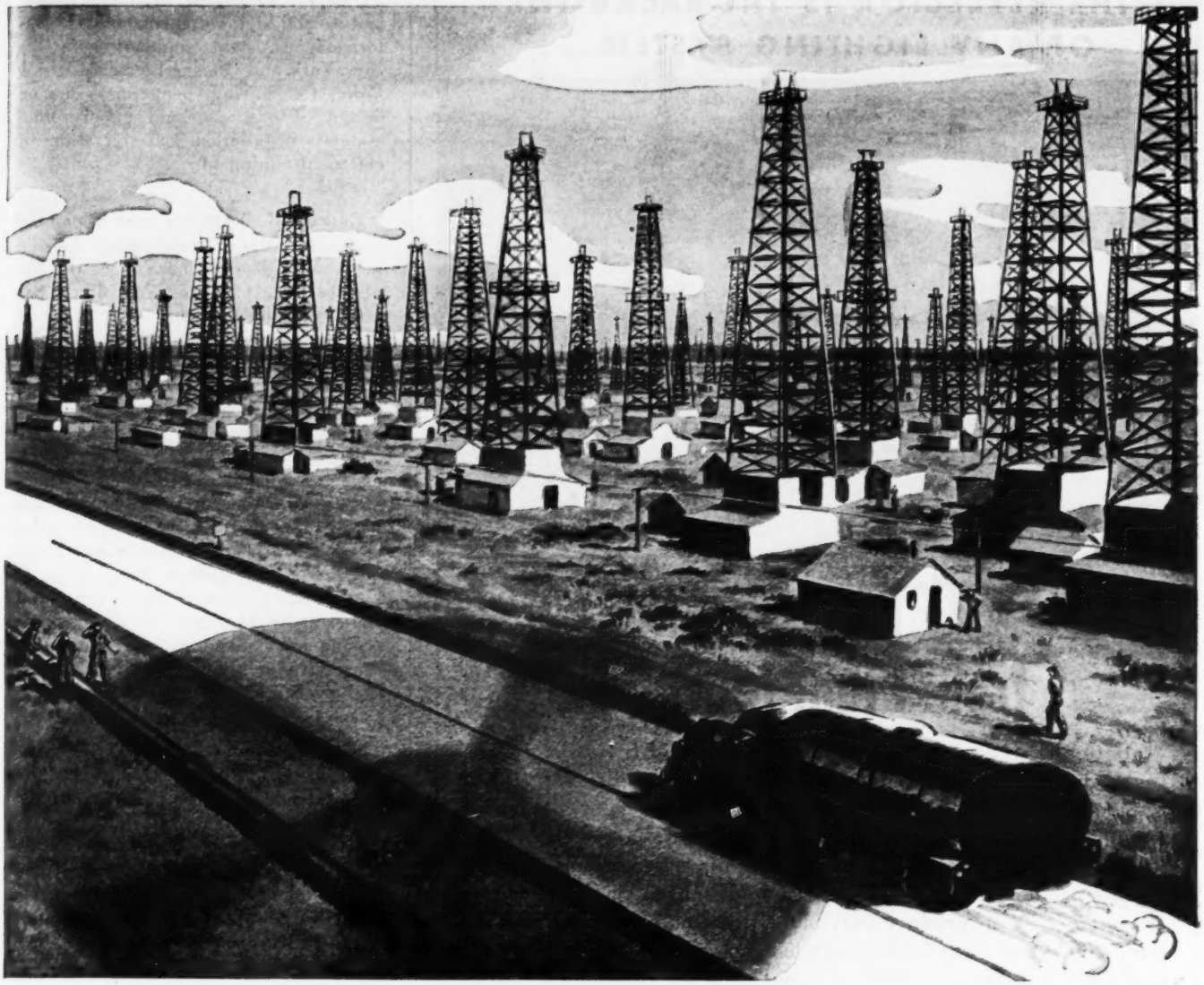
▶ THEODORE S. BONNEMA, formerly production manager of the Oster Manufacturing Co., Cleveland, Ohio, has been made vice-president in charge of production and LESTER D. MARTIN, formerly comptroller, has been named treasurer. Both men have been associated with the company in various capacities for more than 20 years.

▶ DAN S. MACCORKLE has resigned from the sales department, Habirshaw Division, Phelps Dodge Copper Products Corp., following an association of eight years with that organization. He was a sales engineer during the first five years of this period, working with utilities, industrials, and contractors throughout the country and during the past three years he handled sales of

★ NUMBER 13 IN A SERIES OF MESSAGES BY KELLETT AIRCRAFT CORPORATION ★



"COMING EVENTS CAST THEIR SHADOWS . . ."

Over busy cities . . . industrial scenes . . . rolling farm country . . . wild, wooded regions, the shadows of rotary wings will be familiar sights . . . as helicopters take their place in future air transportation. Today, details of helicopter advances in design and in performance are not available to the public . . . but the progress made during the war, under Government sponsorship, promises a practical, useful type of aircraft with special flying abilities, freeing it from airport limitations. Kellett's experienced engineers and production organization look forward confidently to the time when the helicopter will serve alongside conventional aircraft, in the air-minded world of tomorrow.

. . .

SEND FOR INTERESTING BOOKLET

Are there questions in your mind about what the helicopter can do, its capacity, cost or speed? Send for "Answering Some Helicopter Questions." Kellett Aircraft Corporation, Dept. E, Upper Darby (Philadelphia), Pa.

KELLETT

OLDEST ROTARY WING AIRCRAFT MANUFACTURING COMPANY

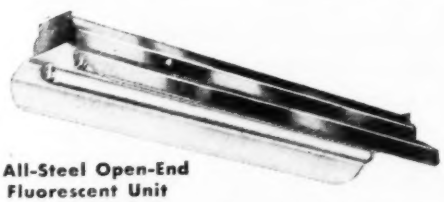
THE REFLECTOR IS THE BACKBONE OF ANY LIGHTING SYSTEM . . .

Light lifts the Shadow from Plant Morale!

Better lighting of the Wheeler type . . . *Skilled Lighting* . . . means higher morale through reduced eyestrain and fatigue. When you raise morale with Skilled Lighting . . . backed by Wheeler's advanced engineering . . . you automatically get better production too!

Wheeler reflectors for fluorescent and incandescent installations are the product of 64 years of specialized light engineering. They are *engineered* to produce maximum illumination from standard lamps. They are *built* for long service and easy maintenance: high-grade, heavy duty materials throughout . . . heavy vitreous enameling that really stands up and retains its high reflection factor.

Learn how you can brighten morale and boost production – get acquainted with Wheeler's complete line of Reflectors. Write for Catalogs. **Wheeler Reflector Company, 275 Congress St., Boston 10, Mass.** Also New York. Representatives in principal cities.



All-Steel Open-End Fluorescent Unit

Available for two or three 40-watt, or two 100-watt lamps. Broad wiring channel with accessible, enclosed ballast. Can be mounted from chain or conduit, individually or in continuou runs.

RLM Solid Neck Incandescent Reflector

Maximum lighting efficiency for either indoor or outdoor use. Expertly designed, ruggedly built. 75 to 1500 watts.

Distributed Exclusively Through Electrical Wholesalers

Wheeler Skilled Lighting REFLECTORS

Made by Specialists in Lighting Equipment Since 1881

all types of power cables, concentrating on paper, varnished cambric, rubber and special high voltage cables. He was formerly assistant engineer with the New York and Queens Electric Light & Power Co., having spent nine years on design of overhead and underground systems, installation and operation of electrical equipment.

▶ GREGORY L. REES has been appointed range and water heater sales division manager, Edison General Electric Appliance Co., Chicago. Mr. Rees has been with the company since 1935 as development engineer and special sales representative on ranges and water heaters. During the war period he had charge of the demonstration and sale of company developed war devices. He will be located at the company's Chicago headquarters. In other personnel changes announced, H. J. SCAIFE was named manager of the western sales region, with headquarters in San Francisco. He relinquishes the position of kitchen sales manager and is succeeded by JOHN FELLMANN. FLOYD SLASOR was named manager of the refrigeration sales division. Both Mr. Fellman and Mr. Slasor will remain at Chicago headquarters.

▶ HERBERT B. REYNOLDS, until recently superintendent of motive power of the IRT Division of the New York City transit system, has been given the duties of superintendent of power generation for the entire system, which is a consolidation of the Interborough Rapid Transit Co., the Brooklyn Manhattan Transit Co. and the Independent System. In this position he has charge of all the power stations in the system.

▶ ERNEST MENHALL, secretary and treasurer of the Highway Trailer Co., has been elected president of the company to succeed P. J. E. Wood. OLIVER H. PAYNE, chairman of the board of the Liberty Aircraft Products Corp., which owns approximately 60 percent of the common stock of Highway Trailer, was elected to the newly created office of chairman of the board of the Highway Trailer Co.

▶ JOHN A. FERGUSON, senior member of the Missouri Public Service Commission, has resigned to become executive director of the Independent Natural Gas Association of America.

▶ FRANK W. RANDALL, president of the New England Gas & Electric Service Corp., Cambridge, Mass., has been elected president of the board of trustees of the University of New Hampshire, Durham, N. H.

A modern maintenance tool for utilities

G-E 2-WAY FM RADIO

Government regulations now permit new installations of 2-way FM radio for important requirements of utility companies. Let your G-E representative help prepare your applications.

"Watch-dogging" distribution systems to assure power continuity under year-round conditions of natural and accidental hazards is a major responsibility. Tomorrow, expanded power systems bringing with them the ever-growing problems of exposure, will increase that responsibility.

For improving "round-the-clock" service even beyond present high standards and meeting emergencies throughout your circuit mileage, use G-E 2-way FM radio. It will provide the means for immediate dispatch of maintenance crews from one job to another. It will save valuable repair time. It will lower maintenance costs. Call your G-E sales engineer when you discuss your communication problems. He will have a competent specialist assist in planning the most effective system for your particular installation.

In serving your 2-way radio communication requirements, G. E. offers the same specialized attention and reliable service that is extended to you in your power distribution and maintenance requirements. *Electronics Dept., General Electric, Schenectady 5, N. Y.*

Write for these booklets: "G-E FM Communication System Guide" is a bulletin that gives practical every-day-language facts about the selection of 2-way FM radio and will assist you in estimating total installation costs. "G-E FM Communication Equipment Catalog" describes and illustrates the required units and accessories.

Tune in General Electric's "The World Today" and hear the news from the men who see it happen, every evening except Sunday at 6:45 E.W.T. over CBS network. On Sunday evening listen to the G-E "All Girl Orchestra" at 10 E.W.T. over NBC.

GENERAL ELECTRIC

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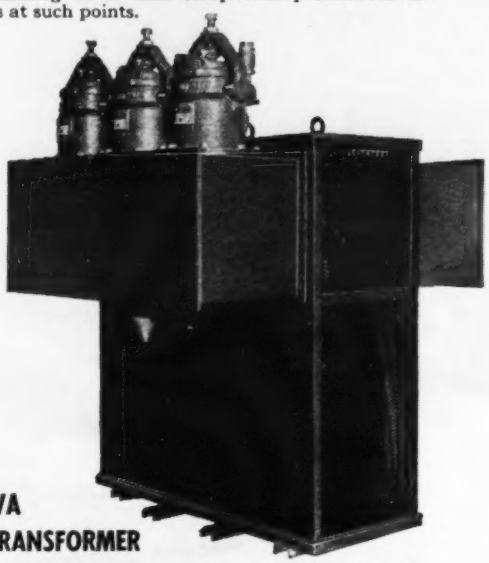
DAVIS TRANSFORMERS

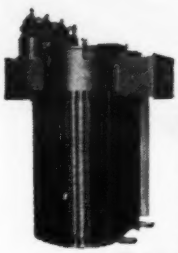
Reliability

Davis Transformers have proven their reliability in years of uninterrupted service, which means FREEDOM FROM FAILURE, saving you trouble, delay and expense. Our years of experience, not only in manufacturing, but also in repairing and rebuilding other makes of transformers have shown us the most frequent points of failure, thus enabling us to take exceptional precautions to eliminate failures at such points.

DAVIS DRY TYPE
Natural Draft Cooled

DAVIS 100 KVA, three phase, Class "B" Insulated, Dry Type, 4160Y—208Y Volts, with special G&W oil fuse cutouts.





DAVIS 200 KVA OIL COOLED TRANSFORMER
DAVIS 200 KVA, three phase, Oil-cooled, 2400/4160Y—120/208Y, with special G&W oil fuse cut-outs.

● COMPLETE REPAIR AND REBUILDING SERVICE

For years we have been "transformer repair headquarters" for leading utilities and industrial companies. We offer complete repair and rebuilding service. All work guaranteed same as that of original manufacturer. A large stock of used transformers for sale—similarly guaranteed. Write us.

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Manufacturers of Oil Cooled, Dry Type, Power and Distribution Transformers
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OBITUARY

James D. Donovan

James D. Donovan, president of the American Public Power Association and prominently identified with the municipal utility field, died on December 20 in Kansas City, Kans., at the age of 59. He was manager of three Kansas City municipal enterprises—the Fairfax airport, the water department and the light and power division. Mr. Donovan was serving a third time as president of the American Public Power Association at the time of his death and had headed the Kansas Association of Municipal Utilities since it was formed under his guidance sixteen years ago. Mr. Donovan was born in Kansas City, Mo.

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▶ SVEND E. JOHANNESEN of Pittsfield, Mass., retired electrical engineer, died in Yonkers, N. Y., on December 22 at the age of 79. Born in Norway, Mr. Johannesen came to the United States as a child and received his education at Roanoke College and at Rose Polytechnic Institute. He started his career with the Wagner Electric Manufacturing Co. in St. Louis in 1893, and was soon put in charge of the transformer engineering department. In 1902 he became identified with the Westinghouse Electric & Manufacturing Co. in Pittsburgh as a designing engineer of certain types of transformers used in electrical railway systems, and helped to design transformer equipment for the Interborough subway and for the electrification of the New Haven Railroad. Mr. Johannesen joined the General Electric Co. in 1906 and worked as an electrical engineer in Pittsfield, Mass., until his retirement in 1932. In 1926 he received the Coffin Award for his developmental work on the distribution transformer.

▶ HENRY P. KNISKERN, southern division sales manager of Landers, Frary & Clark, died at Little Rock, Ark., on December 9, following a brief illness. Mr. Kniskern had represented Landers, Frary & Clark in the southern area since his connection with the Universal sales organization in 1926.

▶ CLIFFORD P. COCHRAN, electrical contractor of Nashville, Tenn., died in that city on December 13 in his seventy-fifth year. His death was caused by burns sustained in a fire which broke out in a building in which he was engaged in electrical repairs. Known as the "dean of local electricians" Mr. Cochran was born in Atlanta, Ga., but had lived in Nashville most of his life. He was the last living electrician connected with

RCA's New 170-A Audio Chanalyst

Tests Everything from Microphones to Multiple Speakers

THE new 170-A Audio Chanalyst is a combination testing unit which includes the famous Voltohmyst circuit, a new diode flat through the audio range, a B.F.O. signal source, a gain calibrated amplifier, speaker and line output connections.

The various channels of the RCA Type 170-A can be used independently or in unison to check all common defects in audio amplifiers and sound systems. Polarity indication and a.c. can be determined instantly with the new electronic indicator, without danger of overload!

A pamphlet containing full description and specifications of the 170-A Audio Chanalyst will be sent gladly, on request.

Please use this coupon ↓

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Radio Corp. of America, Camden, N. J.

Please send the bulletin describing the new RCA 170-A Audio Chanalyst to:

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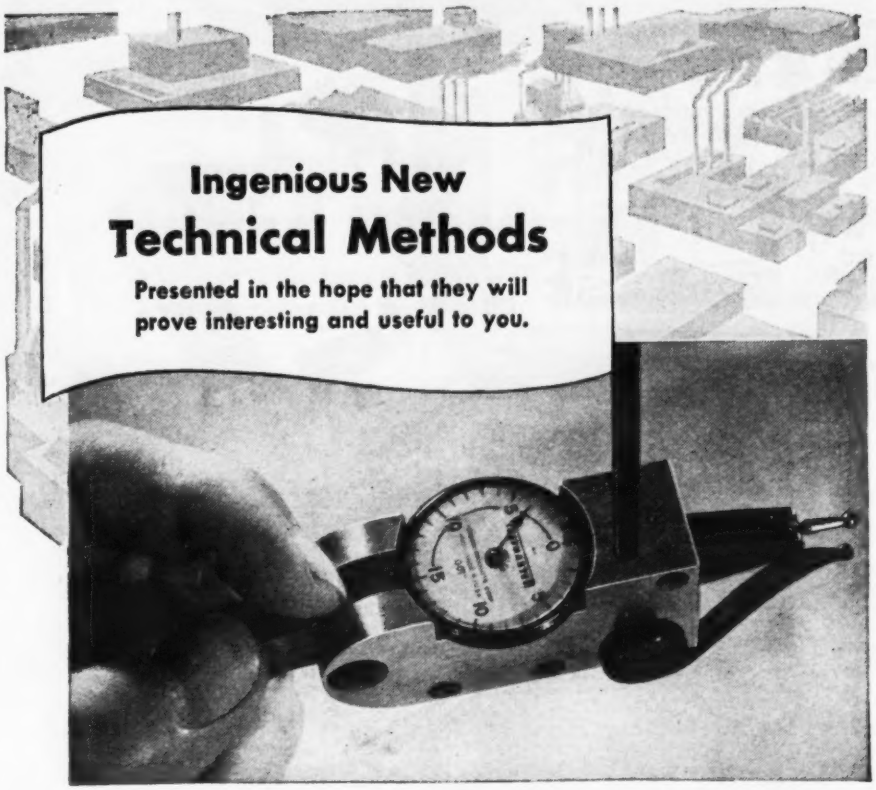
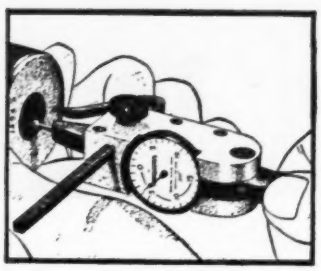


New Internal Gage Avoids Over Cutting . . . Saves Wasted Man Hours

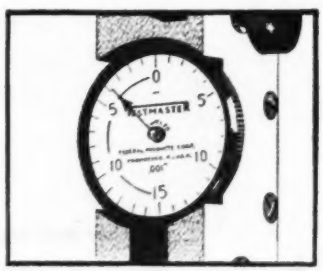
At last a gage that takes the guess work out of checking internal diameters either machine bored, or close ground and lapped. It is called the Keene Internal Gage and is the first accurate method for fast correct checking of internal splines and gears on both minimum and root diameters. The gage is ideal for machining and inspection work, and proves its value in increased production. It can be used with either a master, or micrometers.

This time saving development is constructed of aluminum, is six inches long and weighs only five ounces. Available in models designed to read in thousandths (.001) or in tenths (.0001).

When your gage has been checked the thousandths left to bore, the actual job of machining may become tedious. It is then when Wrigley's Spearmint Gum helps keep you alert and watchful. Chewing gum seems to assist you over the dull spots in the day's work. And Wrigley's Spearmint will aid you in your peacetime job by helping to keep you wide awake and efficient during that part of your work that may seem unimportant, but which actually means perfection to the completed product.



Determining correct setting for gage.



Closeup of dial showing simplicity and fast visibility.

You can get complete information from Keene Electrical Machinery Co., 542 W. Washington Blvd., Chicago 6, Illinois

2-53

the elaborate wiring system set up in Nashville for the Tennessee Centennial in 1896. He was also the chief electrical engineer for the St. Louis World's Fair in 1904. Mr. Cochran began his electrical work with the Atlanta Railway & Light Co. in the 1880's. He went to Nashville in 1894 and was connected with the old Nashville Railway & Light Co. for more than 20 years, with his service with the various public exhibitions interspersed. He served as city electrical inspector from 1915 to 1919. About 15 years ago he entered private business.

► WILLARD G. BAUSMAN, industrial lighting consultant of the Southern California Edison Co. at Monrovia, was killed in an automobile-train accident on November 15 when the company car he was driving was struck by a speeding passenger train at a rural crossing. Mr. Bausman first joined the utility in 1930, but left to become associated with a lighting fixture manufacturer, rejoining the company again in 1935 as a commercial lighting specialist in the Alhambra division. He had been at Monrovia since 1943.

► CHARLES F. LOUGHEAD, prominently identified with the steel industry for many years and president of the American Transformer Co., Newark, N. J., at the time of his retirement in 1934, died on December 23 at the East Orange (N. J.) General Hospital after an illness of two days following a heart attack. He was 63 years old. Mr. Loughead was born in Oberlin, Ohio, and was graduated from Western Reserve University.

► WILLARD HALL, vice-president of the Times Appliance Co., Inc., New York, died on November 29 at his home in Hastings-On-Hudson, N. Y. He was 59 years old. Mr. Hall started his career with the Westinghouse Electric & Manufacturing Co. in Boston, later joining the Western Electric Co., New York. He then became appliance manager of the Brooklyn Edison Co., a position he occupied for three and one-half years. Before becoming identified with the Times Appliance Co. in 1928 he was associated with John Wanamaker, Inc.

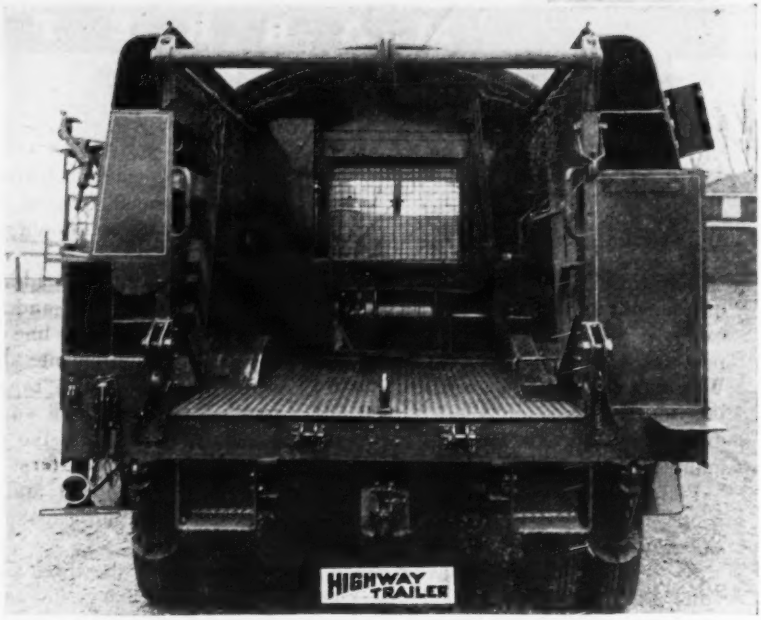
► JOSEPH E. BELL, 62, civil engineer for the Montana Power Co., died December 7, in Butte, following a heart attack. Mr. Bell was born in 1882 in Wakefield, Va. He had been employed by the Montana Power Co. for the past 30 years.

► CHARLES A. PEPPER, 69, sales manager for the Sheboygan, Wis., district of the Wisconsin Public Service Co., died November 23.

Everything SHIP SHAPE

Look at a Highway Line Construction Body loaded with various tools and materials and you see complete order. Not only is the body designed so that every inch of space can be utilized, but when such is the case, everything is ship shape. Quick accessibility to the tools and materials saves time.

The bodies are beautifully balanced, assuring proper weight distribution.



HIGHWAY *Line Construction* BODIES

In suggesting now that you look ahead to the adoption of these bodies, we believe that your post war planning will call for this kind of efficiency and economy. Let us at this time supply you with details on the various types of line construction bodies so that you can be fully informed and prepared.

HIGHWAY TRAILER COMPANY

MANUFACTURERS OF

TRUCK TRAILERS AND BODIES • EARTH BORING MACHINES • WINCHES • OTHER PUBLIC UTILITY EQUIPMENT

General Offices

EDGERTON, WIS., U. S. A.

MANUFACTURING MARKETS

Westinghouse Adds West Coast Facilities

Acting to meet heavy wartime requirements and also in anticipation of excessive demands which the early post-war period is expected to produce, Westinghouse Electric & Manufacturing Co. recently completed a $1,000,000 expansion program to its West coast manufacturing and repair facilities.

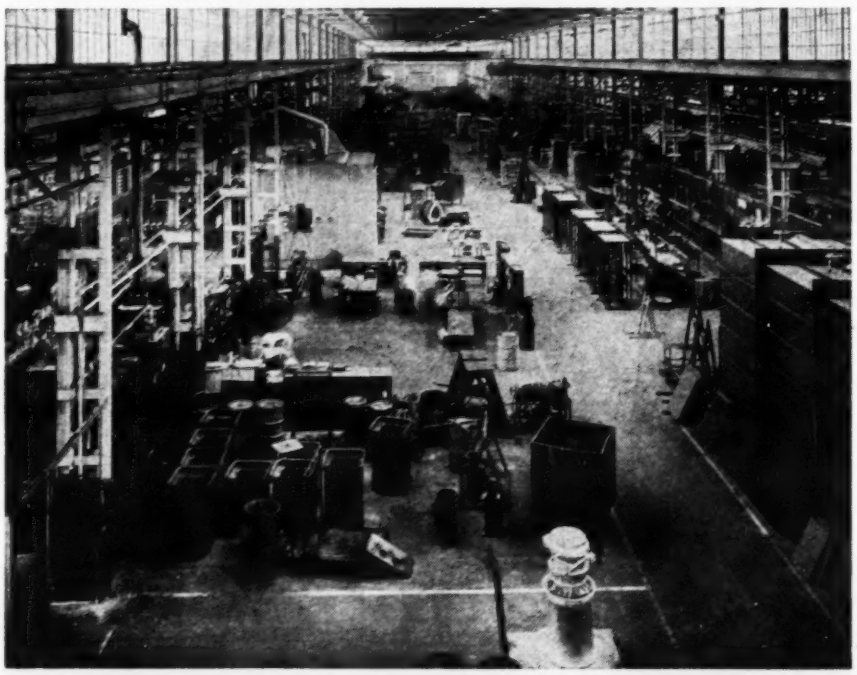
Plants affected by the expansion program were those at Emeryville and Los Angeles, and at Portland, Ore.

At the headquarters plant at Emeryville, the program included the construction and equipment of a new building adding 44,000 sq.ft. of floor space, bringing the total plant area to 264,000 sq.ft. Repair facilities were rearranged, expanded and modernized. New tools were installed. A completely new section was tooled and staffed for the manufacture of steam-driven turbine blowers, and motor and transformer manufacturing facilities were rearranged to straight line production ending at the shipping department.

At Los Angeles, additional floor space was obtained and shops rearranged to straight line production. New tools, equipment and facilities were provided, and repair capacity doubled. At Portland, space was materially increased and the recently purchased larger quarters were rearranged and retooled, and new facilities added. Repair capacity was quadrupled.

Activities of the three plants include the manufacturing or assembling of electrical apparatus such as switchboards, control panels and panelboards, power distribution boards, motors, gearmotors, distribution and power transformers, turbine blowers and various Micarta products.

Because of the nature of its products, Westinghouse anticipates no post-war reconversion problems.



WESTINGHOUSE EMERYVILLE, CALIF., PLANT—Production flow arrangement in this bay permits straight line manufacturing of transformers on the left, switchgear in the center and electric motors on the right, all converging at the freight car slot in the shipping department. The repair department and the marine blower department are located at the far end of this building

Universal Announces New "U" Campaign

"U" Plan for Better Living is the keynote of Universal's 1945 advertising campaign which is being announced by Landers, Frary & Clark, New Britain, Conn. Coming on the heels of the nationally known "U" Plan for "V" Day, which 16,000 dealers are now making use of to bring about millions of consumer contacts this new, forceful campaign will continue to enforce the basic formula of the "V" Day plan and incorporate many new features to make post-war appliance selling an easier and better performance.

With the "U" Plan for "V" Day laying the groundwork in '44 by building up a large potential market for different types of appliances the "U" Plan for Better Living will concentrate on bringing to the American consumer the specific Universal products to be made in post-war days and show how the American housewife can easily purchase complete household equipment, from Universal when manufacturing is again underway.

"The Government has clearly indicated that production of appliances will commence slowly throughout the ensuing year," declared B. C. Neece, vice-president in charge of sales, "and Universal will be prepared to give to the American public the products that it has wanted throughout these war years. We are proud of our record in the manufacture of war goods which is still at a high level and we further propose to continue contributing to the improvement of better living through intelligent research and engineering of electrical products."

•

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

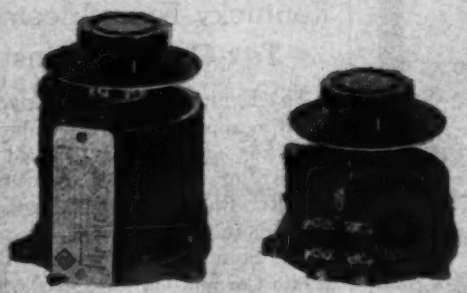
W. N. Matthews Corp., St. Louis, Mo., has appointed J. F. Collins, with offices in the Statler Building, Boston 16, Mass., as sales-engineering representative in the states of Massachusetts, Maine, New Hampshire, Vermont and Rhode Island.

General Controls Co., Glendale, Calif., has appointed James King field sales engineer in their New York factory branch, 101 Park Avenue.

Cook Electric Co., Chicago, has named Frank W. Coburn, Detroit district manager with offices in the Penobscot Building. Mr. Coburn will be in charge of sales, development and field engineering of the entire Cook line. He will also represent the Metal Fusion Corp., a Cook subsidiary.

Silvray Lighting, Inc., Bound Brook, N. J., has announced the return to their

A NEW VARIAC FOR 400 TO 2600 CYCLES



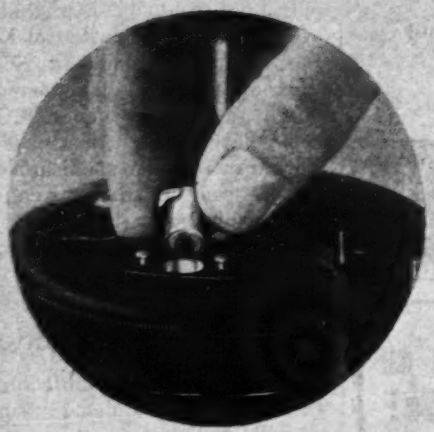
200-CU 60 ~ NEW 60-AU 400-2600 ~

SAME POWER RATING

DESIGNED for an increasing number of applications requiring the control of power at frequencies higher than 60 cycles, this new VARIAC meets the need for a unit for frequencies between 400 and 2600 cycles. It is a companion to the widely used Type 200-C having substantially the same power rating . . . 860 va; with a load current of 5 amperes, rated, and a maximum current of 7.5 amperes near zero and line voltages.

A number of new mechanical features are incorporated in the Type 60-A VARIAC. Included are:

- **New unit brush construction requiring no tools for brush replacement and designed to prevent contact between brush holder and winding when the brush wears away.**
- **Positive rotor contact with NO pigtail**
- **Combination screw and solder terminals**
- **Fully insulated hollow steel shaft**
- **Improved bearings, suitable for motor drive**

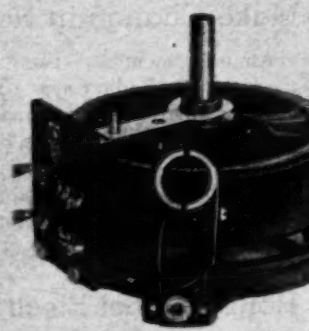


UNIT BRUSH — REPLACED IN A FEW SECONDS

As seen in the photograph, the Type 60-A VARIAC is considerably smaller than its 60-cycle counterpart. The Type 60-AU is priced at $13.00 and the 60-AM at $15.00.

Because all VARIAC production is scheduled months in advance on high priority war orders for 60-cycle models, these new VARIACS are now available only in sample quantities.

• WRITE FOR BULLETIN 919



POSITIVE ROTOR CONTACT WITH NO PIGTAILS

TYPE 60-AU

TYPE 60-AM

VARIAC

MADE ONLY BY

GENERAL RADIO COMPANY

Cambridge 39, Mass.

NEW YORK
CHICAGO
LOS ANGELES

see how

*COLOVOLT

Cold Cathode Low Voltage Lamps can answer your Lighting Problems

1. Maximum lighting and operating efficiency (10,000 hours life expectancy). Guaranteed for 1 year except for failure due to breakage.
2. Low initial cost and maintenance.
3. Instantaneous starting, constant illumination.
4. Easy-to-look-at, reduces glare and eye strain.
5. Many other exclusive features, told in new booklet "Facts about Colovolt." Send for your copy today.

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GENERAL LUMINESCENT CORPORATION
660 S. Federal St. Chicago 5, Ill.

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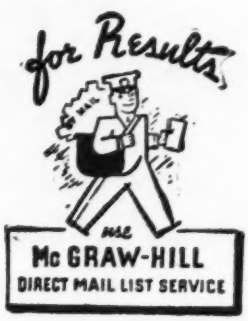
Ask the distributor of *Crapo* Galvanized Products near you or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

What Makes a Mailing Click?

Advertising men agree . . . the list is more than half the story. McGraw-Hill Mailing Lists, used by leading manufacturers and industrial service organizations, direct your advertising and sales promotional efforts to key purchasing power.

In view of present day difficulties in maintaining your own mailing lists, this efficient personalized service is particularly important in securing the comprehensive market coverage you need and want. Investigate today.



McGraw-Hill Publishing Co., Inc.
DIRECT MAIL DIVISION
330 West 42nd Street, New York, 18, N. Y.

field sales organization of John E. Artopoeus, who has been named central district sales manager. Paul E. Bowers has joined the Silvray sales organization and has been assigned to the upper New York State territory.

•

Kentucky Loses Income Tax Claim Against RCA

The Kentucky Court of Appeals has ruled against the State's claim for income tax on royalties received by the Radio Corporation of America, from the Ken-Rad Tube & Lamp Co., of Owensboro, Ky.

The State had brought action against Radio Corporation for $98,602 in taxes, penalties and interest from the time the state income tax law became effective in 1936 through 1941, the suit being brought in behalf of the State Revenue Department.

The Appellate Court ruled that the only relationship between Radio Corp. of America, and Ken-Rad of Kentucky, was a contract made in New York, whereby the Kentucky company produced radio tubes under R.C.A. patents. This contract was made in New York, royalties were paid in New York, and the court ruled that Kentucky had no jurisdiction in the matter, in that it was not income in Kentucky.

•

Apex-RCA Pact Made

Apex Electrical Manufacturing Co., Cleveland, has completed arrangements with RCA Victor for the post-war distribution of its electrical products abroad.

•

Make Change in Name

Announcement has been made that the Lafayette Radio Corp., Chicago, has changed its name to Concord Radio Corp. The post-war plans of the company include the establishment of a number of strategically located branches in various parts of the country.

•

Holtzer-Cabot Electric Sells Signal Division

Holtzer-Cabot Electric Co., Boston, Mass., has announced the sale, effective December 30, of its signal systems department to the Faraday Electric Corp., Chicago. President Sydney D. Maddock stated that the transaction involves no sale or exchange of capital stock, but covers commercial signal systems, inventories of such apparatus, patents and tools required in its manufacture.

Holtzar Cazot will continue the manufacture and sale of its other products.

THE PROBLEM

The Buckeye Laboratories Corpora:
2890 East 83rd St.
Cleveland, Ohio

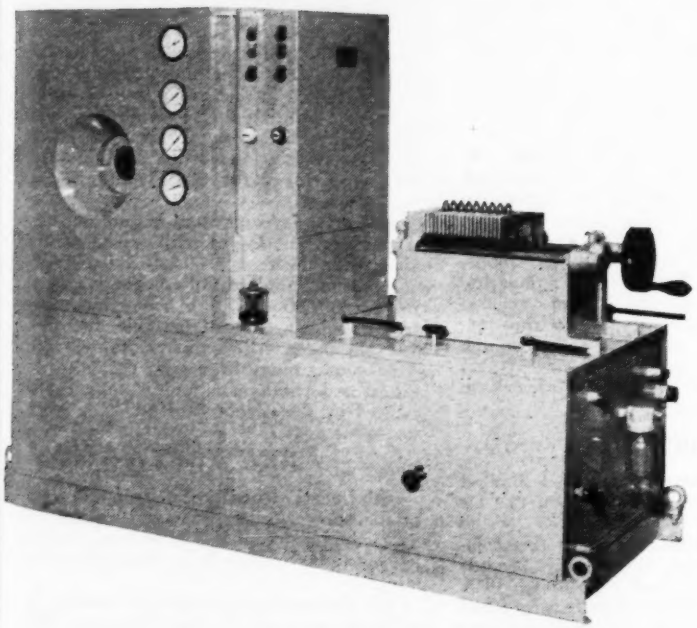
Gentlemen:

We believe that your equipment can correct an oil problem with which we are troubled.

Although the oil has a high dielectric, we have water, in solution in the oil, that a centrifuge or blotter press will not remove. The water condenses on the cold cover as globules and falls back onto the windings. Our oil has a relatively low acid content, free from sludge;

THE ANSWER

THE HYDROVOLIFIER



This inquiry from a large utility is typical of many we receive. The Hydrovolifier has been successful in correcting many similar conditions—because it removes all water, both free and in solution, from the oil. Here's how it's done. The oil is forced through atomizing nozzles into a vacuum chamber. This treatment transforms all water (both free and in solution) into vapor which is drawn off and discharged.

The Hydrovolifier is also being used successfully to remove volatile (corrosive) acids—sludge and other impurities.

Available in three standard sizes.

HV—100—Capacity 100 gal. per hour
HV—300—Capacity 300 gal. per hour
HV—500—Capacity 500 gal. per hour

BUCKEYE
LABORATORIES CORPORATION

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Washington, D. C.

OAKLAND—GEORGE A. KUSHMAN CO., 428 13th Street, Oakland 12, California

RELIABLE CAN HELP YOU

SAVE TIME

in speeding the war program by using Reliable Straightline splices on new construction and on maintenance.

SAVE COPPER

by using these perfect joint making units over and over again.

RELIABLE

STRAIGHTLINE SPLICE

Positive
Permanent
Low in Cost

Reliable ELECTRIC COMPANY
OVER 35 YEARS SERVICE TO THE UTILITIES

Field Reports on Business

Naval orders are still being placed in large volume. Among the electrical supplies included are small motors, resistors, pumps, wiring material and communication equipment. As expected, the holiday season's electrical mechandise turnover was exceedingly small. Exterior illumination was on a small scale, but a little floodlighting was in evidence.

NEW ENGLAND

Industrial activity is leveling off from the peak reached in November, but the overall picture for Massachusetts manufacturers indicates an output but slightly under the total for the last quarter of 1943, with employment and wages stabilized at about one percent below a year ago.

The Massachusetts Legislature has already appropriated $4,700,000 for the acquisition of Boston waterfront property and plans are afoot which involve the appropriation of about $15,000,000 more for additional property, piers and facilities for modernized handling of cargoes. This should call for substantial amounts of motor-driven conveying and hoisting equipment when approved, with heavy wiring installations, improved controls and lighting facilities.

As expected the holiday season's electrical merchandise turnover was pitifully small, barring scattered sales of flashlights, portable lamps, and window lighting sets. Exterior illumination was on a small scale, but a fair number of creches were displayed in the cities and suburban areas, and here and there a little floodlighting was observed.

U. S. Navy submarines are scheduled for immediate launching in New England shipyards. Negotiations by Dewey Almy, Cambridge, for acquisition of a mill at Adams, Mass. are under way, with expectation of producing artificial leather after extensive improvements are completed. Large bearing orders increase for naval use and the demand for industrial boilers for war plants expansion has been stepped up most vigorously.

Recent naval orders include G.E. small motors, Sprague resistors, monowatt plugs, Sturtevant pumps. Raytheon and submarine signal communication equipment, general radio supplies, optical supplies, wiring material, insulating products and machine tools, notably from Connecticut. Naval negotiationed contracts in this area have increased substantially.

CHICAGO

Although the production of a limited number of electric water heaters for domestic use has been authorized by the WPB, local manufacturers report that commitments will absorb their entire production through the second quarter of 1945. Dealers here report that they have not had a single water heater in the past two months.

The electric range situation is a little different than that for water heaters. WPB plans for the country call for 140,000 electric ranges to be made in 1945 or about 12,000 fewer than this year. All will go to fill military needs or to approved consumers. Electric irons, long promised to consumers, fell far short of their 1944 national goal with only 700,000 to 800,000 expected out of an approved 2,037,838 for the nation.

Sales of department stores operating in the seventh (Chicago) federal reserve district will reach an all time yearly high mark of $1,172,000,000 in 1944 the Federal Reserve Bank of Chicago estimates with Chicago stores' sales expected to exceed $330,000,000. Local merchants, however, are pessimistic on probable 1945 sales predicting a drop below 1944 levels.

Building permits issued in Illinois during November were less than in October but above a year ago. Permits numbered 1,921 and were valued at $5,572,263, compared with 2,554 and $7,021,669 in October and 2,262 and $3,654,287 a year ago. New residential construction represented the largest portion of November building activities and was 68 percent above a year ago. Building permits in Chicago in November were 39 percent lower than in October.

PACIFIC COAST

San Francisco's $20,000,000 bond issue for its Mills Field airport expansion will, if approved, be supplemented by expenditures, aggregating $60,000,000 from 13 airline customers, a sizable portion necessarily covering electrical equipment.

Pacific Coast labor conditions are somewhat easier in commercial establishments, though still acute in industrial plants and yards, despite the fact that western states rank high in replacement of discharged service men, California being first in the nation with 8.7 percent of the total.

Prospective orders include a $68,888 low bid for revision of Mare Island machine shop lighting; bid proposals for $400,000 power development at Beaver Falls near Ketchikan, Alaska; a group award covering airport lighting for naval auxiliary air stations in California; anl a low bid of $353,202 covering electric facilities for naval drydock at Terminal Island in Los Angeles area.

Industrial developments include a new shipyard at San Pedro with an 18,000-ton capacity drydock; a $200,000 cafeteria installation at Standard Oil's Segundo plant; and a $750,000 award to a Portland firm for knock-down tropical barracks for overseas shipment. Preliminary reports on wholesalers annual inventories points to the highest in several years, and are apparently justified by the necessity of quick delivery.

NEW YORK

With enemy resistance stiffened and serious shortages in some war equipment reported, the acecnt has fallen on production for victory rather than preparations for peace.

Civil engineering construction volume for the short week due to the Christmas Holiday totalled $23,150,000. This volume for continental United States, was 18 percent under the corresponding 1943 week; one percent below the previous four-week moving average, but exceeding the $20,225,000 reported to *Engineering News-Record* for the preceding week. Private construction was 48 percent lower than in the 1943 week, and public construction was down 7 percent due to the 20 percent decrease in federal volume. The week's construction brought 1944 volume to $1,729,753,000 for the 52 weeks, a decrease of 43½ percent from the $3,061,844,000 reported for 1943.

In spite of restrictions, consumers' expenditures rose to a new record figure in 1944, according to a summary made public by the Department of Commerce.

It's YOUR future—Make the most of it!

Start now to earn the bigger pay in electrical repair

Was there ever such an opportunity to get started in electrical maintenance and repair—and at top-notch wages? Are you ready—with experience and ability—to cash in on it? Others are getting just the sort of background needed—quick! practical!—to handle the great variety of electrical maintenance and repair work TODAY—from this well-known electrical library. You can too!

Electrical Maintenance and Repair Library

5 volumes, 2042 pages, 1721 illustrations

Gives you the "know-how" to tackle any wiring or motor job. Five books show you HOW—to install all types of motor and generator units—to inspect and repair motor starters and generators—to diagnose motor and generator troubles—to figure new windings for old cores, DC and AC windings—to test armature windings, test induction motors, etc., etc. The new book is full of trouble-shooting charts that show .quickly symptoms, causes, specific remedies, etc.

Includes trouble-shooting book

Now in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a handy book giving helpful maintenance information, special trouble-shooting charts, explanations of symptoms and causes of machinery troubles, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

10 days' examination

Easy monthly payments

We want you to examine this Library for 10 days. If you don't want them at the end of that time, there's no obligation to keep them. On the other hand if you decide you want the help these books can give, start the small monthly payments then, and in a short time the books are yours, right while you have been using them. Send the coupon today.

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Send me Electrical Maintenance and Repair Library, 5 volumes, for 10 days' examination. If I find the books satisfactory, I will send you $1.00 in 10 days, and $2.00 a month until $15.00 has been paid. Otherwise I will return the books postpaid.

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the "Mite-y" Basket

MISTER 5½"x3⅜"

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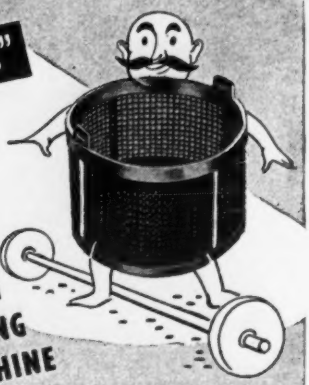
L&R INDUSTRIAL PRECISION CLEANING MACHINE



He's a 'mite-y' performer with limitless applications. He'll hold one large instrument or three small ones...myriad screw machine products or countless jewels...parts of radio tubes or components of motors... stupendous quantities of crystals or just a few of your tough babies too difficult to clean manually or by any other method. He's tried and true, and devoted already to the cause of the Army, Navy and more than 300 war industries, utilities and airlines.

L & R MANUFACTURING COMPANY

577 ELM STREET • ARLINGTON, N. J.

CLEAN - RINSE - POLISH - DRY with L & R in one complete, self-contained unit

Royal-ettes

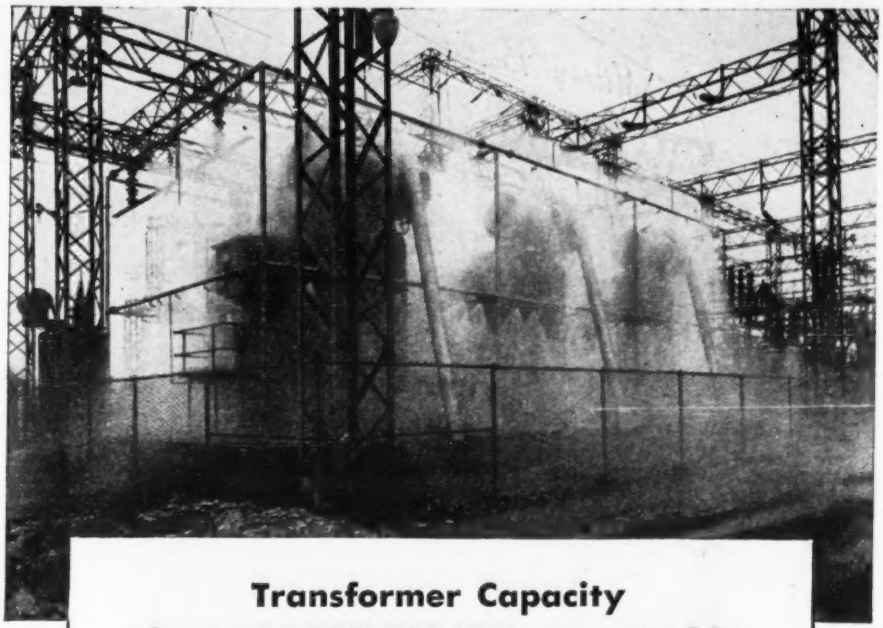
#2 in a series of informative news letters from a producer of Power Switching Equipment.

We don't think we're going out on a limb when we tell our customers we're building—and will continue to build—equipment the company will stand back of so long as there is a Royal Electric Mfg. Co. With a policy of this kind, I think we are justified in saying we are building equipment a little better than the average. Honestly, we would starve to death on our parts business; you don't get replacement parts orders unless your stuff is falling apart somewhere.

As Royal is not particularly well known nationally, we feel it is necessary to build better equipment than our nationally known competitors in order to get the same customer consideration. I am sure our products are subjected to much closer scrutiny than the similar product of a better-known manufacturer. For this we are grateful, for we get a real kick out of having anyone inspect Royal products.

We are essentially a manufacturer of power switching equipment, but we have found it desirable, and in keeping with our policy of flexibility and versatility, to manufacture anything required, within the scope of our engineering talent and machine equipment. This policy has, to a large extent, helped Royal keep pace with the progress of changing times and needs, and has added materially to the number and variety of items in our catalog. In the next few ROYAL-ETTES we are going to refer to some of the items in this catalog, telling about their history, development, and uses. We hope some of you will write us for a copy (it's yours for the asking), in order to follow these discussions.

ROYAL ELECTRIC MFG. CO. 619 E. 40th Street CHICAGO 15, ILL.



Transformer Capacity of over 10,000,000 KVA protected by GRINNELL MULSIFYRE SYSTEMS

Leading utilities in the United States and Canada have chosen Grinnell Mulsifyre Systems to protect more than 10,000,000 KVA of transformer capacity. Numerous other Mulsifyre installations protect circuit breakers, switches, regulators, and similar oil-filled equipment.

In several instances, the choice was made after comparison tests of Mulsifyre with other types of fixed protection. Mulsifyre makes *immediate* action certain — extinguishes flames within a few seconds, before they spread destruction to adjacent equipment.

MULSIFYRE SYSTEMS operate on the principle of emulsifying blazing oil with a driving spray of water. The oil is turned into a liquid which is incapable of burning. Fire is extinguished in a few seconds and reignition is prevented.

Complete separation of water and oil takes place in a few hours . . . leaves oil undamaged.

There is absolutely no conductivity along the discharge of a Mulsifyre projector when spray strikes conductors carrying high voltages.

Mulsifyre Systems are permanently installed . . . they operate automatically or manually.

Recommended by Underwriters' laboratories for use in extinguishing fires in flammable oils immiscible with water, wherever such oil is a fire hazard – in transformers and other oil-filled electrical equipment.

See that your equipment has this 24-hour-a-day protection, before fire strikes. Experienced Grinnell engineers will help you plan protection for your specific needs.

GRINNELL COMPANY, INC.
Executive Offices, Providence 1, R. I.
Branch offices in principal cities.

GRINNELL *Mulsifyre*
AUTOMATIC FIRE PROTECTION

Sales Opportunities

MARYLAND—Pennsylvania Railroad Co., Broad St. Station, Philadelphia, Pa., will make extensions in line electrification in vicinity of Baltimore, and will purchase soon about 400 tons of structural steel for poles and other structures. Project is understood to have a priority rating.

UTAH—John K. Monroe, 2150 Curtis St., Denver, Colo., architect, acting for Order of Catholic Sisterhood of St. Benedict, St. Joseph, Minn., is completing plans for new power plant in connection with hospital and nurses' home at Ogden. Bids are scheduled to be asked soon. Project has a priority rating and will include other utility structures.

NEW YORK—Celanese Corp. of America, Inc., 180 Madison Ave., New York, manufacturer of rayons, chemicals, plastics, etc., plans new central research laboratory; tract of 22 acres of land has been acquired. It will consist of several buildings, estimated to cost close to $1,000,000, with mechanical and electrical equipment. Application will be made soon for a priority rating.

ALASKA—Ketchikan Public Utilities Department, Ketchikan, will close bids January 17 for construction of municipal hydroelectric power development, including erection of reinforced-concrete power house, 30 by 69 ft.; 2,100 ft. of 28-in. and 2,100 ft. of 30-in. welded steel pipe for water supply; 970-ft. tunnel and installation of sluice gate and control stand; and construction of 11.3 miles of transmission line. Estimated cost $400,000. Financing in part has been arranged through federal aid and project has a priority rating. Roy W. Johnson, Hoge Bldg., Seattle, Wash., is consulting engineer.

LOUISIANA—Town Council, Kenner, has secured federal permission to construct a power line for service at airport, with control station and other facilities at terminus. It is understood that installation will be made by Louisiana Public Utilities Co., furnishing local service.

NORTH CAROLINA — Burlington Mills Corp., Greensboro, manufacturer of rayon piece goods and hosiery, is arranging an expansion and improvement program at mills in North Carolina, Tennessee and Virginia, to be carried out as a post-war project over a period of 48 months. Work will include installation of additional machinery and modernization of certain present equipment, with electrical equipment and other facilities. Entire project estimated to cost over $2,000,000.

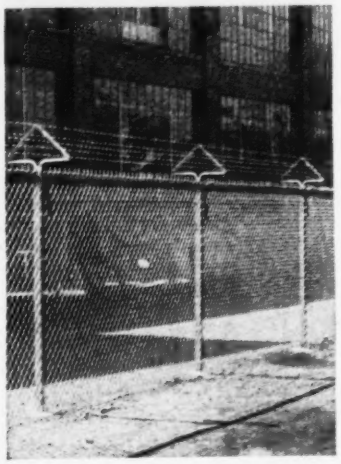
NEBRASKA—Consumers Public Power District, Columbus, plans extensions in transmission line. Application has been made for permission.

FLORIDA—U. S. District Engineer Office, Mobile, Ala., is asking bids until January 16 for installation of an automatic coded fire alarm system in warehouse areas and station hospital, Dale Mabry Field (Ser. No. 45-119).

NEW YORK—Duramold Division, Fairchild Engine & Airplane Corp., 524 West 52nd St., New York, manufacturer of aircraft parts, has purchased plant of American Aviation Corp., Jamestown municipal airport, Ellicott, near Jamestown, idle for a number of months past, and will occupy for new factory. Two present plants in New York will be consolidated at new location, with installation of additional machinery and electrical equipment for in-

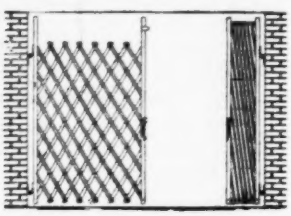
Stewart IRON and WIRE FENCES

Metal restrictions have been modified to permit the manufacture and sale of Chain Link Wire Fence, Folding Gates, Window Guards and Wire Mesh Partitions for certain industrial uses. You may be able to qualify. So tell us what you need and we will advise as to priority procedure.



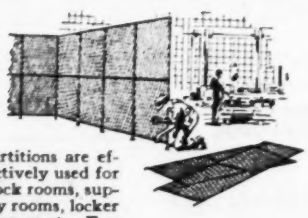
Typical Stewart 5TH Chain Link Wire Fence Installation

STEEL FOLDING GATES



Furnished in single or double gate construction. When requesting prices send sketch indicating width and height of opening.

WIRE MESH PARTITIONS and WIRE WINDOW GUARDS



Partitions are effectively used for stock rooms, supply rooms, locker rooms, etc. For prices, send sketch indicating lineal footage, arrangement of doors, pass-out windows, etc. Window Guards are furnished any size, any shape. Made with ⅜" or ½" round frame or ¾" to 1" channel frame. When writing for prices, indicate width and height of openings. Also state anchorage conditions.

THE STEWART IRON WORKS CO., Inc.
1201 Stewart Block
CINCINNATI 1, OHIO

creased capacity. Output will be for government, which will provide financing in amount of $525,000 for project through Defense Plant Corporation. Work is scheduled to be carried out at once.

OHIO—Civil Aeronautics Administration, Municipal Airport, Cleveland, plans expansion and improvements in aircraft engine research laboratory, including additional buildings and installation of machinery and electrical equipment. Fund of about $4,120,000 is being arranged for program.

MICHIGAN—Ford Motor Co., Dearborn, plans power plant, consisting of two buildings, at branch works. Bids will be asked at once for erection. Project will have a priority rating. No official estimate of cost announced.

PENNSYLVANIA—City Council, City Hall, Philadelphia, plans new power plant for service in City Hall in connection with other utility improvements in structure. Project will be carried out as a post-war development and is estimated to cost over $900,000.

WYOMING—Bureau of Mines, Department of Interior, Washington, D. C., and Laramie, has plans nearing completion and will take bids soon for proposed new laboratory on campus of University of Wyoming, Laramie, particularly designed for shale investigations. It will be three and four-story, about 175 by 200 ft., and is estimated to cost about $680,000, of which approximately $200,000 will be expended for technical apparatus, mechanical and electrical equipment. Appropriation has been authorized in that amount. H. P. Rue is Bureau contracting officer at Laramie. Frederic H. Porter, 2118 Central Ave., Cheyenne, is architect.

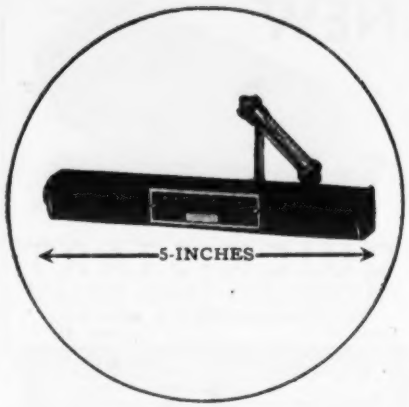
WISCONSIN—Water Works and Lighting Commission, Wisconsin Rapids, plans call for bids early in March for motor-driven pumping equipment, controls and accessories in connection with extensions in water supply system. Also for construction of power line to new pumping station site. Foth, Boyd & Porath, 400 East Walnut St., Green Bay, are consulting engineers.

NEW YORK—Dairymen's League Cooperative Association, Inc., 11 West 42nd St., New York, plans new four-story dairy and milk products plant on 12th Ave., between 47th and 48th streets, totaling about 88,000 sq. ft. floor space. It will be carried out as a post-war project, or as soon as materials and equipment are available. Cost estimated about $650,000, with machinery and electrical equipment. Jacob Feld, 103 Park Ave., New York, is architect and engineer.

CONNECTICUT—City Council, Windsor Locks, and Civil Aeronautics Administration, Washington, D. C., plan installation of lighting system at local municipal airport, estimated to cost about $66,000. Federal appropriation in that amount is being arranged.

MICHIGAN—Board of Public Works, Coldwater, plans extensions and improvements in municipal steam-electric power plant as a post-war project, primarily for expansion in steam division. Installation will include new boiler unit, cooling tower and miscellaneous equipment. Cost estimated close to $300,000. Froehlich & Emery Engineering Co., Toledo Tower Bldg., Toledo, Ohio, is consulting engineer.

UTAH—Denver & Rio Grande Western Railroad Co., Rio Grande Bldg., Denver, Colo., plans two one-story shop buildings at yards. Cost reported close to $100,000, with mechancial and electrical equipment. Application will be made for a priority rating.



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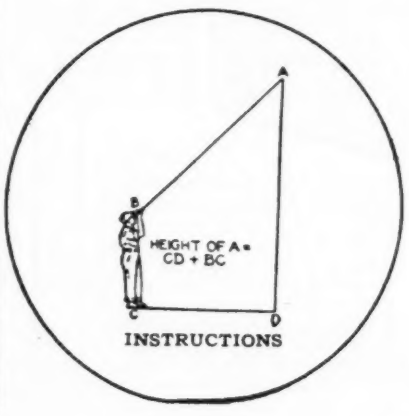

INSTRUCTIONS

NEW

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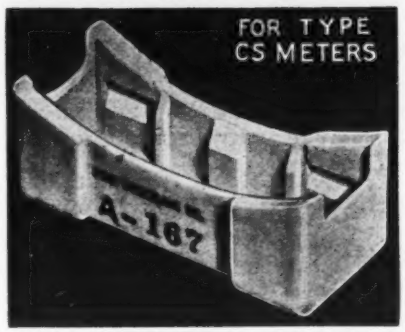

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Locust St., Haverhill, Mass.
Applicants must comply with WMC regulations

Recent Rate Changes

ROCKLAND LIGHT & POWER Co. has been ordered by the New York Public Service Commission to reduce its street lighting rates in Port Jervis, N. Y., $2,000 a year. The decision was rendered on a complaint filed by the city when it was unable to renegotiate a satisfactory contract with the utility.

PRAIRIE DU SAC (Wis.) municipal electric utility has announced that its 470 residential and commercial customers will save $1,940 yearly in electric bills through a rate reduction recommended by the state Public Service Commission and accepted by the village board.

CEDARBURG LIGHT AND WATER COMMISSION has cut its residential electric rates in the amount of $4,779, commercial rates $2,835, and small power $2,060, effective December 1. The negotiations for this reduction had been in progress since last March.

CARRGLL ELECTRIC COOPERATIVE, serving 3,000 members in north Arkansas, has voted to reduce its monthly minimum charge from $2.50 per month to $1.75 per month. Members will be allowed 25 kilowatt-hours for the $1.75 minimum.

•

New Standards Adopted for Varnished Tubing

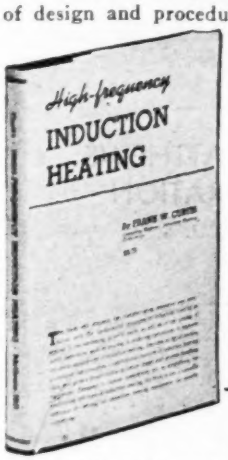
The proper selection of the type and grade of flexible varnished tubing and sleeving for various insulating requirements has been facilitated by the comprehensive set of standards adopted by Varnished Tubing Association, Inc.

New standards cover tubing and sleeving made from cotton, rayon, nylon and glass and include the physical and electrical characteristics of the different standard grades that are available and the manner in which they should be designated when ordered.

The new standards have been published in 8½ by 11 size for convenient use and filing. Copies may be obtained from the Varnished Tubing Association, Inc., 420 Lexington Avenue, New York 17, N. Y.

Open the way to stepped-up production with high-frequency induction heating

Here is your answer to production problems in metal working—a technique of applying high-frequency current to give rapid, localized, intensive heat . . . quickly, easily . . . and *economically*. Now all the material you need on theory, practice, and application has been gathered together in one convenient and comprehensive book—ideal both as an introduction to the possibilities of induction heating, and as a ready reference handbook of design and procedure.



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235 pages, 5¼ x 8¼, 249 illustrations, $2.75

Written by a specialist in the field, this book gives a clear and thorough understanding of the practical techniques of this *stream-lined* method of heating metals . . . explains the fundamental electrical principles involved . . . defines its range and scope . . . describes construction design of induction-heating coils . . . discusses in detail many applications of induction heating to specific heating problems . . . and discusses the marked effect the technique will have on manufacturing methods and future constructional design.

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1. Principles of Induction Heating
2. Types of Induction-Heating Equipment
3. Design of Induction-Heating Coils
4. Brazing, Soldering, and Joining
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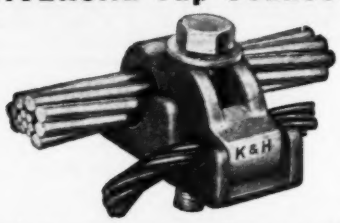
Better, Safer Jacks Since 1899

A Live Wire is no better than its Connections

UNIVERSAL Tap Connector



Effectively used as guy line ground, or transformer and lightning arrester connection to A. C. S. R. or copperweld conductors where the diameters may be from 8-A copperweld to .595" A. C. S. R. armour rods. Wire sizes .595" to 5/32".

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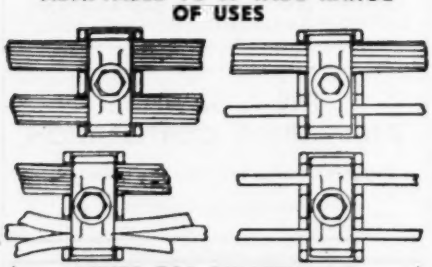

★ WRITE FOR BULLETIN 8-B ★

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Solderless Terminal Lugs and Connectors
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LETTER TO THE EDITOR

Food for Thought— Or IS it?

To the Editor of ELECTRICAL WORLD:

When the hurricane hit the East Coast a couple of months ago and the electricity went off, do you know what people missed most?

Nearly everybody managed to dig up some candles from somewhere, or a flashlight. So we didn't mind the lack of lights so much. The washing and ironing could wait. A great many send it to the laundries these days anyway. We could struggle along without the vacuum, too, and go without toast for breakfast, but the ice-box! The milk got sour and all the stuff was spoiling. The refrigerators were the most missed among the many items in the house depending upon electric service for their operation.

Now here's the amazing thing about it.

Believe it or not, Mr. Editor, most housewives did not realize their electric refrigerators were run by electricity!

Don't argue with me. I got this straight from the best of all possible sources, too (don't argue with me about this either)—my wife. The first time was when she said, "Poor Ethel, she's having a terrible time with the refrigerator not running—everything's spoiling. She said she never realized that electricity ran it."

I remarked, "That's kind of dumb. What did she think ran it?"

"It's not dumb," my wife came back, "Vera said the same thing, too, this afternoon."

Then the next night she told me of three or four more like instances from some of her other girl friends that she was talking with on the 'phone and (get this) "How is it the telephones are working all right and the electricity isn't? Those telephone people sure did a wonderful job. I hear they brought hundreds of men in from all over to get things fixed up quick."

Well, the clincher came the next morning when on the way to work I met a friend of mine who is a chemist. I mention his occupation to show he ought to be somewhat above the average intelligence. This gentleman said to me, "Say, do you know where I can get a rubber belt for the refrigerator? When I left this morning my wife told me to get one because the ice box won't work. Once before it went on the blink and it was because it needed a new

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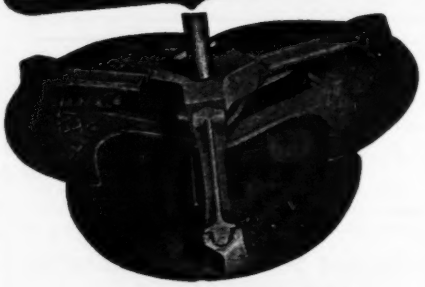

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belt, so I guess that's what's wrong."

I asked him, "Did the lights go on again in your house yet?"

"Oh, migosh!" exploded the chemist, "That's what it must be. The current's not on yet."

So you see, Mr. Editor, even he did not think of electricity in connection with his electric refrigerator.

This little homily was started with "Food for Thought—Or IS It?" I don't know. But wouldn't you think it looks as though there has not been a very good selling job done somehow? Not on selling ice-boxes, but upon selling people on the value of what we naively refer to as "electric service." Maybe that's not it, but it seems to me as though it ought to prove something when it takes a hurricane to make people discover their electric ice-boxes are run by electricity. Maybe it's the people's fault. Or IS It? Possibly, just as customers have come to take electricity for granted, is it not likely that we have come to take it for granted that they appreciate what they're getting?

Could it be we could use a little of old man Cato's medicine* in this direction?

George Kerr,
Ebasco Services,
New York, N. Y.

* "Delenda est Carthago."

•

New REA Allotments Total $643,000

The Rural Electrification Administration has recently made loan allotments totaling $643,000 to ten cooperatives in seven states, bringing the total of REA loans to $515,575,301.

Unless otherwise indicated the loans which are listed below will be used for the extension of electric service to farms located near existing lines. No construction will be undertaken which does not meet with the approval of the War Production Board.

NEBRASKA—Burt County Rural Public Power District, Tekamah, $25,000 for tie line and substation construction.

NORTH CAROLINA—Woodstock Electric Membership Corp., Belhaven, $53,000; Pamlico-Beaufort Electric Membership Corp., Grantsboro, $31,000.

NORTH DAKOTA—Cass County Electric Cooperative, Inc., Kindred, $110,000.

OKLAHOMA—Choctaw Electric Cooperative, Inc., Hugo, $100,000; People's Electric Cooperative, Ada, $50,000.

TEXAS—Southwest Texas Electric Cooperative, Inc., Eldorado, $150,000; Hunt-Collin Electric Cooperative, Inc., Greenville, $14,000 for purchase and rehabilitation of an office and storeroom building.

VIRGINIA—Northern Neck Electric Cooperative, Warsaw, $50,000.

WASHINGTON—Benton Rural Electric Assn., Prosser, $60,000.

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(Classified Advertising)

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Discount of 10% if full payment is made in advance for 4 consecutive insertions.

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ELECTRICAL ENGINEERS—Operating Utility in Colombia, S.A. requires District Superintendent having hydro and diesel generation and preferably also electric distribution experience. Also Distribution Engineer, preferably with some plant experience. Knowledge of Spanish desirable but not immediate necessity. Positions permanent. P-797, Electrical World, 330 W. 42nd St., New York 18, N. Y.

MIDWEST ELECTRIC utility plans to reorganize its industrial relations work with a new division intended to handle all labor matters. Very satisfactory and pleasant relations now exist with employees. The man wanted to organize and conduct this work should have well-rounded experience in utilities labor relations, a good personality, mature judgment, and be a worker as well as a thinker. Age 30 to 45. Write details of experience, personal qualifications and availability. P-801, Electrical World, 330 W. 42nd St., New York 18, N. Y.

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SALARIED POSITIONS — This advertising service of 35 years recognized standing negotiates for high salaried supervisory technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission's. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

ELECTRICAL ENGINEER, University Graduate, registered professional engineer, 20 years experience as industrial power engineer with large utility, interested in making a change. Would like position as power sales supervisor or assistant to sales manager. Could take charge of electrical maintenance in large industrial plant. Age 45, married, excellent references. Would consider South America or Mexico. PW-794, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

RATE ENGINEER or executive assistant: Thoroughly competent to plan and coordinate post-war rate program. 20 years diversified experience, 9 as head of rate department of large utility, 3½ with regulatory commission, 4½ as utility statistician or accountant, 3 in other lines, including electrical manufacturing. Now employed by regulatory commission. Degree in public utility economics and business administration with 3 years course in electrical engineering. Age 45, available on 30 days notice. Good health, best references. Permanency desired. PW-802, Electrical World, 330 W. 42nd St., New York 18, N. Y.

Additional Employment Advertisements on page 146

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LATIN AMERICAN US graduate engineer 24 years experience in one of the most varied fields of power production and utilization desires position covering Latin American territory as traveling engineer for American manufacturer on salary or salary and commission. Age 45. SA-796, Electrical World, 330 W. 42nd St., New York 18, N. Y.

SALES MANAGER wanted to head bronze wire and rod department of well-established concern. Excellent opportunity for the right man, both now and postwar. State age, education, experience, other qualifications and compensation desired. SA-803, Electrical World, 330 W. 42nd St., New York 18, N. Y.

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WANTED

Radio Engineer for installation, maintenance and servicing essential electronic equipment in United States and abroad. Electrical background and *practical* radio experience required. Age 28-40. Salary $3600 up plus living expenses. Wire or write Radio Division, 2519 Wilkens Avenue, Baltimore 23, Maryland, for application form.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.

EXPORT SALES ENGINEER

Excellent opportunity for experienced sales engineer who has travelled foreign countries, with thorough knowledge all types prime movers—steam, internal combustion, electric — offered by large western manufacturer with broad postwar field. Mechanical and electrical training essential, knowledge foreign languages, acquaintance foreign purchasing groups in Washington, D. C., or other large centers desirable.

SW-775, Electrical World
68 Post St., San Francisco 4, Calif.

SALES MANAGER

for plant manufacturing large and small transformers. Must be an experienced salesman with some experience in the control of salesmen and agents and capable of handling correspondence with sales staff. Traveling required.

SW-784, Electrical World
330 West 42nd St., New York 18, N. Y.

WANTED

ELECTRICAL ENGINEER

For old established eastern manufacturer. One who can design and manage transformer department, who understands all phases of transformer design and building. Only engineers thoroughly familiar with building and calculating on all types of air and oil cooled transformers need apply. Steady position and good salary to right man.

P-800, Electrical World
330 West 42nd St., New York 18, N. Y.

WANTED

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A Central New England manufacturer employing over 1000 people needs Draftsman-Designer on telephone and signaling (mechanical) apparatus.

Knowledge of die-casting and plastic applications desirable.

WMC Regulations Prevail

P-798, Electrical World
330 West 42nd St., New York 18, N. Y.

WANTED

EDITORIAL ASSISTANT

Excellent position is available for technical editor and writer. Man must have thorough knowledge of principles of electrical engineering. Should have facility as a writer and be able to review and to analyze critically the writings of others on engineering subjects. This is a permanent position and offers excellent opportunity to a man with imagination, good engineering background, and writing ability. Starting salary $3600. for applicant who in our judgment fully meets our requirements. Write Supervisor, Technical Employment, 306 Fourth Avenue Pittsburgh, Pennsylvania.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.

FOR SALE

1—General Electric. **Rotary Converter** Type T. C. 6-300-500 25 cycles Speed 500 Amps 500 Volts 600 Serial No. 114778 (one Field needs repairs) with G. E. operating Panel No. 124448 Ampere Meter D.C. Switch Rheostat & remote control 100 Ampere Oil Switch G. E. Type F. Form K2.

1—General Electric **Transformer** type H.R.T. Form R.R. 25 cycle, 330 K.V.A. Volts 13200/11880 370—180 Resistance 15% Serial No. 990819.

3—General Electric **Transformers** Type H.J. Form K.D.D. cycles 60. 100 K.V.A. approx. 10½% Reactance 150% 2 hrs. 60°C Volts 13200 to 445. 143 Gal Oil, No. 10 G. E. transit, instruction book 85204 Serial Nos. 3179015, 3179016, 3179017

1—**Rotary Converter** General Electric Type H.C.C. Form P. 300 K.W. C.C. Amps 500 D.C. Volts 600 60 cycles 1200 R.P.M. Serial No. 156008

SWITCHBOARDS

1—General Electric 60 cycle **Rotary panel** 13200 volts 30 Amps.

1—General Electric D. C. **Rotary Panel** Type C.S.R. 300 K.W. Amps 800 Volts 600

1—General Electric **Starting Panel** R.E. 014519 Type A.T.R.S. 300 H.V.A. Amps 770 Volts 360

1—Westinghouse **Induction Motor** Type C. 3 H.P. Atts 3000 Amps 5.7 Serial No. 186926, 25 cycles

1—Westinghouse **Induction Motor** 20 H.P. E. M. F. 335. Amps per terminal 32.3 pnase. Full load speed 750 Atts 3000. 25 cycles Serial No. 149568

1—A.C. and D.C. **Motor Generator Set.** Westinghouse type C constant speed induction motor 20 H.P. E.M.F. 335. Amps per terminal 32 3 phase full load speed 720 Atts 3000 Serial No. 149569. Generator D.C. 15 K.W. E.M.F. 120 Amps 125. Speed 720 Serial No. 149384. D.C. Generator 15 K.W. E.M.F. 550 Amps 27.3 Speed 720 Serial No. 149385

12-General Electric D. C. **Feeder Panels** Capacity 1500 Amps Each equipped with G. E. 1500 Ammeter Single Knife Switch and circuit Breaker No. 290742 Type C Form P. Volts 650

Worcester Street Railway Co.
107 Main St., Worcester 8, Mass.

WANTED

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Mechanical and electrical. Graduate or equivalent training. Required for development work in the following branches:

1. Electro-mechanical devices, communication systems. Must be interested in development and familiar with magnetic circuits.
2. Measuring and control instruments. Background should be in electrical engineering, including electronics.

Statement of Availability Required.

P-799, Electrical World
330 West 42nd St., New York 18, N. Y.

Offered Subject to Prior Sale

300 H.P. McIntosh-Seymour Diesel Electric Generating unit, 3 Cyl., 4 Cycle air injection Direct Connected to G.E. Type TRE, Form D.S. Generator, 2300 volts, 3 phase, 60 cycle, also direct connected exciter. Immediately available in Central Kansas.

165 H.P. Busch Sulzer Diesel Electric Generating Unit, 4 Cyl., 4 Cycle air injection Direct connected to G.E. Type TRE generator, 3 phase, 60 cycle, 2300 volts. Shaft extension for exciter, but no exciter. Immediately available in Southwestern Kansas.

E. M. PATCHEN, *Purchasing Agent*
THE KANSAS POWER COMPANY
Great Bend, Kansas

Illumination Engineers

Design Engineer **on Aviation, Marine and Floodlighting equipment—must be able to prepare specifications for manufacture and test of such equipment, also redesign of present equipment. Salary $215 to $300.**

Application Engineer **to analyze proposed illumination projects—must have electrical engineering background and experience on lighting problems. Will be expected to render engineering assistance on negotiations. Salary $215 to $300.**

Write Supervisor of Technical Employment for application, 306 Fourth Avenue, Pittsburgh, Pennsylvania.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

WANTED

D. C. METERS—Type C6
A. C. METERS—60 Cycle

Send us a list of the D.C. and A.C. meters you wish to dispose of. We purchase large and small quantities.

The Electric Meter Corporation
Incorporated 1915
1776 Broadway, New York 19, N. Y.

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We have several thousand transformers in stock for prompt shipment, and invite your inquiries.

PIONEER TRANSFORMER REBUILDERS
We rewind, repair and redesign all makes and sizes.
One Year Guarantee
THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI 27, OHIO

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that other readers can supply
OR . . . something you don't want—
that other readers can use—
Advertise it in the SEARCHLIGHT SECTION

POWER FOR PRODUCTION

MOTORS GENERATOR SETS

1—750 KW, 250 volts, Allis-Chalmers, sync.
1— 75 KW, 125 volt, General Electric, squirrel cage.
1— 15 KW, 250 volt, General Electric, squirrel cage
1—6½ KW, 125 volt, General Electric, squirrel cage.

MOTORS—3 PHASE 60 CYCLE

1—500 H.P., 900 RPM, 440 volt, Lincoln slip ring
1—400 H.P., 220 volt, 1200 RPM, Westinghouse squirrel cage
1—350 HP., 300 RPM, 440 volt, General Electric slip ring
1—250 H.P., 600 RPM, 2200 volt, General Electric slip ring
1—200 H.P., 1800 RPM, 220 volt, General Electrip slip ring
1—200 H.P., 600 RPM, 550 volt, Westinghouse slip ring
1—200 H.P., 600 RPM, 440 volt, Crocker-Wheeler slip ring
1—150 H.P., 1800 RPM, 440 volt, General Electric squirrel cage
2—150 H.P., 1800 RPM, 220 volt, Westinghouse slip ring
2—150 H.P., 1200 RPM, 2200 volt, Westinghouse squirrel cage
1—150 H.P., 400 RPM, 440 volt, General Electric squirrel cage
1—145 H.P., 600 RPM, 220 volt, General Electric synchronous
1—125 KVA, 900 RPM, Westinghouse synchronous
1—125 H.P., 600 RPM, 220 volt, Westinghouse slip ring
3—100 H.P., 720 RPM, 440 volt, General Electric slip ring
1—100 H.P., 600 RPM, 2200 volt, General Electric slip ring
1—100 H.P., 450 RPM, 440 volt, General Electric squirrel cage
1— 90 H.P., 400 RPM, 550 volt, Crocker-Wheeler squirrel cage
1— 75 H.P., 900 RPM, 4000 volt, Electric Machinery synchronous
1— 75 H.P., 900 RPM, 220 volt, Allis-Chalmers slip ring
1— 75 H.P., 720 RPM, 440 volt, Westinghouse slip ring
1— 60 H.P., 1200 RPM, 440 volt, General Electric slip ring
1— 50 H.P., 1800 RPM, 220 volt, Fairbanks-Morse slip ring
1— 50 H.P., 900 RPM, 440 volt, General Electric slip ring

MOTORS—D.C. 230 VOLTS

2—450 HP, 400 RPM, G.E.
1—250 HP, 760 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
1—150 HP, 500 RPM, General Electric, MPC.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1— 50 HP, 750 RPM, Westinghouse, type SK.
1— 50 HP, 700 RPM, Crocker Wheeler.
1— 40 HP, 775 RPM, Westinghouse.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—200 KVA Allis Chalmers 2200—220/110
3—150 KVA, G.E., 33,000 2300/4000 Y.
3—150 KVA, General Electric, 2400/240/480 volts.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, General Electric, 2200-220/110 volts
3— 75 KVA, G.E., 13500-7500/440 volts.
3— 75 KVA, G.E., 2200/220/110 volts.
1— 75 KVA, G.E., 2400/4800/120/240 volts.
1— 75 KVA, G.E., 3 phase, 4156Y-120/208Y.
3— 50 KVA, General Electric, 2200/220/110.
2— 50 KVA, Phgh., 7500/15,000 volts-110/220 volts.
3—37½ KVA, General Electric, 2200/220/440
2—30 KVA, Allis Chalmers, 3 phase, 4156Y/120/208Y
1—25 KVA, G.E., 220/110-20/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—35 HP, 500/1500 RPM, Westinghouse.
1—30 HP, 225/900 RPM, Crocker Wheeler.
1—30 HP, 400/1200 RPM, General Electric.
2—25 HP, 300/990 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
2—11½ HP, 500/1500 RPM, Westinghouse, type SK.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

INSTRUMENTS

25—Westinghouse type U recording ammeters with split core CT.
25—Westinghouse type U recording voltmeters.

TURBO GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 430 volt. bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

J. L. HEMPHILL & CO., INC., *Power Equipment*

New York Phone: LOngacre 5-3227 — 1602 53rd ST., NORTH BERGEN, N. J. — *New Jersey Phone: UNion 3-2600*

Power Equipment

Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries Transformers, Motors, Compressors, Induction Voltage Regulators, Oil Circuit Breakers, etc.

Service backed by 40 years' experience

BREW, WOLTMAN & CO.

52 Church St., New York 7, N. Y.

Rotary Converters—3 Ph. 60 Cy.

K.W.	Make	R.P.M.	D.C. Volts	A.C. Volts
1—1500	Whse.	720	650	11500
1—1250	G.E.	720	250	2300
1—1000	Whse.	900	600	2300
2— 750	Whse.	1200	600	2300/4000
1— 500	G.E.	1200	600	13200/2300

Rotary Converters—3 Ph. 25 Cy.

2—1500	G.E.	500	225/275	6600
1— 500	G.E.	750	225/275	6600

M. G. Sets—3 Ph. 60 Cy.

1—1500	G.E.	360	250	2300/4600
1—1000	G.E.	720	250	2300/4150
1— 500	G.E.	900	250	440/2300
1— 500	G.E.	720	600	13200
1— 400	G.E.	720	250	2300

BELYEA COMPANY, INC.

51 Howell Street, Jersey City, N. J.

LOCOMOTIVES

8-Ton Whitcomb gasoline 36" gauge.
15-Ton Porter saddle tank 36" gauge.
20-Ton Whitcomb Diesel 36" gauge.
21-Ton Porter saddle tank 36" gauge.
30-Ton Vulcan saddle tank 56½" gauge.
67-Ton American six-wheel switcher.
85-Ton Baldwin saddle tank 2-8-2. Oil fuel.

CARS

2—Western Air dump cars. 30 yd. cap.
14—All-steel 50-Ton Gondolas. Immediate delivery.
19—Flat cars. 50 tons capacity. Rebuilt.
40—Hopper cars. 50 tons capacity.
7—Class III tank cars. 10,000 gal. cap.
40—Class III tank cars. 8,000 gal. cap.
8—Class II tank cars. 8,000-gal. cap.

LOCOMOTIVE CRANES

35-Ton McMyler-Interstate. Steam.
20-Ton Link-Belt electric.
22½-Ton McMyler-Interstate. Steam.
25-Ton Browning. Steam.
10-Ton Industrial-Brownhoist. Gasoline.

GASOLINE CRAWLER CRANES

1—Universal, 32 ft. boom, Caterpillar.
1—P & H 600, 60 ft. boom shovel front and dragline.
1—Byers Bearcat 30 ft. boom, ¾ swing.

GASOLINE TRACTORS

2—Allis-Chalmers Model K (one with blade; one without).
1—International T-35, with angle dozer.
1—Caterpillar Model D-35, with blade.
1—Cletrac 40-30, with blade.

THE HARVEY LEFEVRE CO.

500 Fifth Ave., New York 18, N. Y.

Telephone PEnnsylvania 6-3175

FREQUENCY CHANGER

1000 KW, 460 volts, 3 phase, 25 cycle,
300 RPM, 1570 amperes, serial 4,900,000,
1250 KVA 0.8 p.f. 50-deg. rise General Electric, type ATI-10-1250M-300, with amortisseur winding, with 33 KW disconnected exciter, with
1400 HP 460 volts, 3 phase, 60 cycle,
300 RPM General Electric, 1570 ampere,
1250 KVA p.f. 0.9, 50-deg. type ATI-24-1250M-300 form C, with amortisseur winding.

CHICAGO ELECTRIC CO.

1314 W. Cermak Rd. Chicago, Ill.

New "SEARCHLIGHT" Advertisements

must be received by January 12th to appear in the January 20th issue.

Address copy to the Departmental Advertising Staff

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330 West 42nd Street • New York City

DIESELS

ROBERT SCHOONMAKER
Port Washington, Long Island, N.Y
Phone Roslyn 1220

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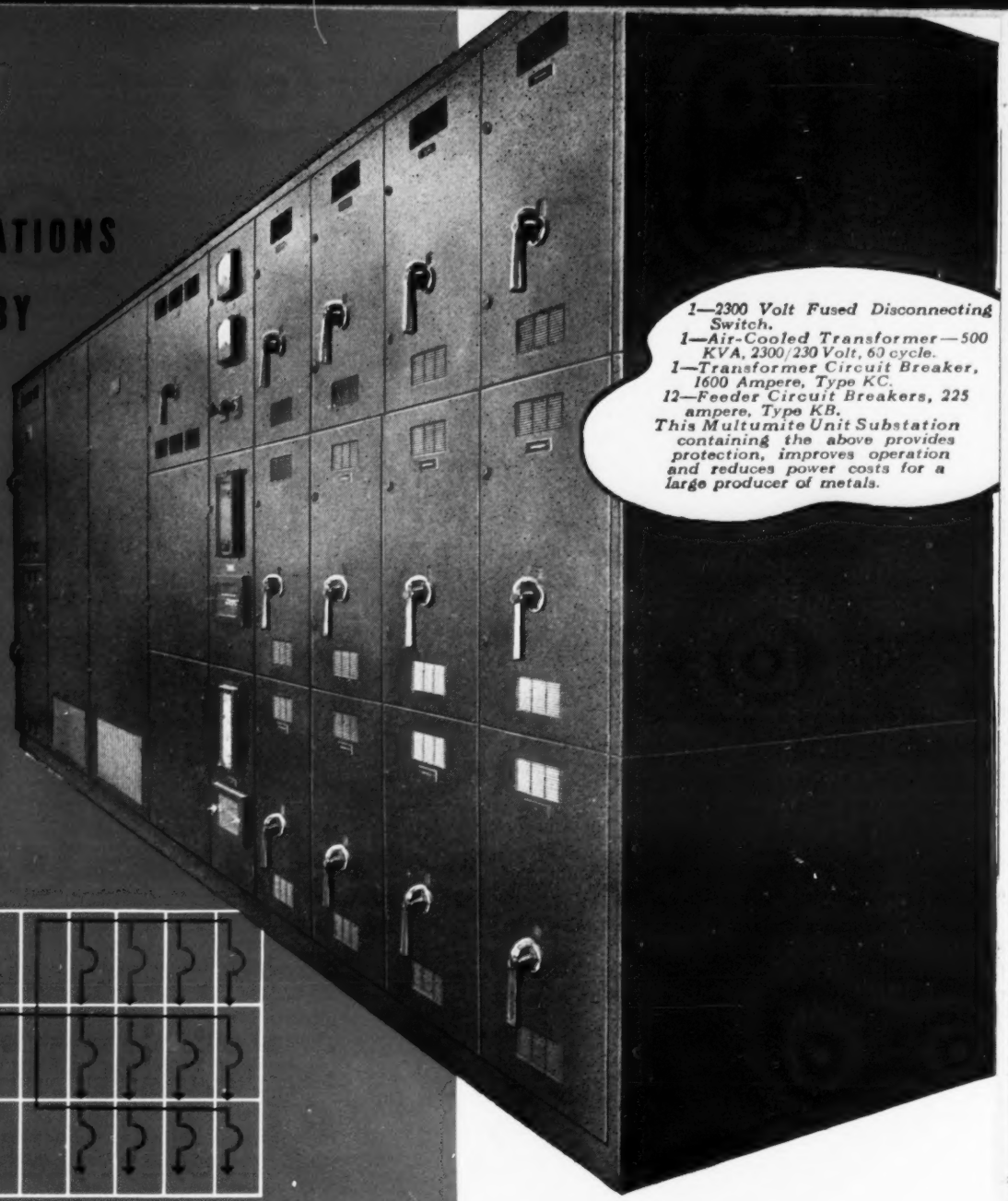
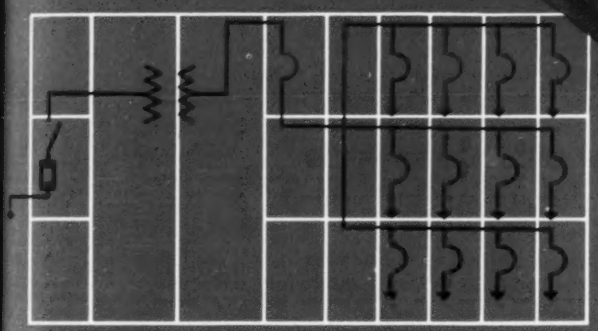
★ **These companies have supplied additional buying information on their products in the 1945 edition of the Electrical Buyers' Reference**

Real

UNIT SUBSTATIONS DEVELOPED BY I-T-E



1—2300 Volt Fused Disconnecting Switch.
1—Air-Cooled Transformer—500 KVA, 2300/230 Volt, 60 cycle.
1—Transformer Circuit Breaker, 1600 Ampere, Type KC.
12—Feeder Circuit Breakers, 225 ampere, Type KB.
This Multumite Unit Substation containing the above provides protection, improves operation and reduces power costs for a large producer of metals.



Following its tradition of pioneering developments which bring new advantages to the user, I-T-E now makes available a real unit substation. The transformer and switchboard are constructed in a *single* completely enclosed unit, compact and functional. There is no throat connection, and no field assembly is required. This eliminates problems of aligning separate units.

The general advantages of power distribution by the substation system include improved voltage regulation, smaller feeder cables and lower maintenance. Added features of these new I-T-E units include increased safety, simplified installation and improved appearance.

Plan to utilize these developments in switchgear designed to meet your individual requirements. Catalog 6010, describing I-T-E Unit Substations in detail, may be obtained from your nearest I-T-E representative or by writing to I-T-E Circuit Breaker Co., 19th and Hamilton Streets, Philadelphia 20, Penna.

I-T-E DESIGN

It is the long established policy at I-T-E to supply switchgear to exactly meet the customer's needs. Rather than to merely approximate specific needs, as must be done within the limits of full standardization, I-T-E always provides custom-made quality—at no extra charge.

I-T-E

REPRESENTATIVES IN ALL PRINCIPAL CITIES

AIR SWITCHGEAR

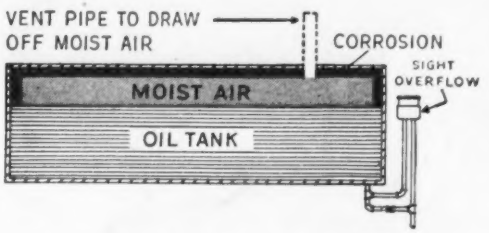
ARMY NAVY I-T-E

LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . .
LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . .

How to eliminate all corrosion in turbine oil systems

Turbine oil alone cannot eliminate all corrosion in a turbine. Here are two suggestions that may help your rust problems.

Cross section of a large oil return line showing how oil covers less than half of the surface of the pipe. This allows moisture to condense on the upper surface inside of the pipe and on high pressure lines enclosed, causing corrosion in the pipe above the oil line. Elimination of this corrosion may require the use of vacuum pumps to remove the moisture-laden air.



Cross section of an oil tank showing how moisture collects on the under surface of the tank top and corrodes it. This may be eliminated by rust-resistant paint or by a vent pipe, as indicated in the diagram. This pipe should not be too long or it may act as a condenser. In severe cases a vacuum pump or other measure is needed to draw off moisture.

TWO TYPES of corrosion occur in a turbine oil system. Either will cause oil discoloration, clogged oil passages, or excessive wear on governor parts. Each type has a different origin.

One type occurs at points in the system seldom reached by the turbine oil; i.e.: on the upper inside surface of large oil return lines or on the inside surfaces of oil tanks, tank covers, etc. (see diagram). This corrosion is caused by excessive moisture in the system. It may be eliminated by the use of vent pipes on tanks or rust-resistant paint. In persistent cases it is advisable to use a vacuum pump on the system to eliminate moisture-laden air.

The second type of corrosion may be found on parts of the system below the oil level or on surfaces in intimate contact with oil. It occurs chiefly with an oil which has had some of its natural corrosion-prevention characteristics removed due to a high degree of refining. This corrosion can be safely eliminated by using a turbine oil—such as Nonpareil Turbine Oil—which incorporates an effective corrosion inhibitor.

This corrosion inhibitor is present in addition to Nonpareil's oxidation inhibitor, which eliminates trouble from asphaltene deposits, sludge, and acidity.

If you have a corrosion problem, a Standard Oil Lubrication Engineer will be glad to analyze it and to make helpful suggestions toward eliminating it. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you.

NONPAREIL
TURBINE OIL

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

Gasoline Powers the Attack . . . Don't Waste a Drop!